CATTLE TUBERCULOSIS

H. SESSIONS

SECOND EDITION

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CATTLE TUBERCULOSIS

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CATTLE TUBERCULOSIS

A Practical Guide to the Agriculturist and Inspector

BY

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PREFACE TO THE SECOND EDITION

THE first edition, which I wrote in conjunction with Dr. Legge, being exhausted, I have been asked by the publishers to bring out a second one. This has practically involved re-writing the book, as during the interval so many fresh experiments have been made and so many new regulations introduced by foreign countries, that I have had to omit a good deal which had become antiquated in my endeavour to bring the book up to date. My object has been to write in such a manner that the subject can be understood by those who have to deal practically with it, yet who, perhaps, have not had the necessary training to appreciate technical phraseology.

Tuberculosis is one of the most serious diseases the community have to face, and a general knowledge of its contagious nature, and the methods of combating it, is particularly needful for agriculturists. I hope also that the regulations which I have inserted from foreign countries and the various statistical tables may be of use to those who are professionally endeavouring to get rid of this great scourge. In the text I have endeavoured to acknowledge those whose works I have quoted.

H. SESSIONS.

IFTON MANOR, ROGIET, MON.
July, 1905.

CATTLE TUBERCULOSIS

CHAPTER I

HUMAN TUBERCULOSIS AND ITS RELATION TO BOVINE TUBERCULOSIS

VERY few subjects have given rise of late years to so much discussion and difference of opinion as that of bovine tuberculosis. The disease affects the interests of widely different sections of the community, but in respect to each it is a matter of some difficulty to estimate exactly the amount. Farmers complain of the losses inflicted on them by its prevalence in their herds, resulting in the death of a certain number of animals; of the lowered price an animal thus affected fetches when sold; and the great difficulty, nay, impossibility, in some cases of telling whether the animal is affected with the disease or not.

The butchers complain that they are the parties whose interests suffer most largely, owing to the risk they are at any time exposed to of having an animal, bought in perfectly good faith as sound, seized and destroyed by an officer of the sanitary authority because, after slaughter, it may be discovered to be affected with the disease. The veterinary profession is interested in the subject from the point of view of its causation, of the extent to which it prevails in domestic animals, and of its treatment and prevention. The medical profession is brought into relation with the disease because of the identity of the bacillus in human and bovine tuberculosis, and of the probability of the transference of it from animals to man, either in the meat or in the milk derived from animals affected with the disease. Lastly, the general public is interested in the subject from a desire to have eliminated one of the sources, even if it be a small one, from which the scourge of consumption in man may arise.

When the knowledge we have to-day as to the causation of the disease and of its effects is compared with that which was possessed twenty years ago, it must be acknowledged that the advance has been immense.

The majority of farmers and butchers then would probably have been mystified by the word 'tuberculosis,' nor would many medical officers of health have imagined that it was necessary to condemn the carcases of animals affected with the disease on the ground that there was a risk to the human subject of contracting the disease from the meat.

During the interval the matter has been subjected, both on the scientific and practical side, to the close scrutiny of three Royal Commissions, and as a result of their investigations it is possible to show wherein the existing law requires to be relaxed and wherein it requires to be strengthened.

It is now held that consumption in man and consumption in the lower animals is caused by the same bacillus, an organism belonging to the lowest form of vegetable life, and so small that, in order to be properly examined, it must be magnified four or five hundred times in all directions. When it gains access into the system, whether of animals or men—and in both it finds an entrance most readily into the lungs—it lives and multiplies on the tissues in such a way as to destroy their functions, and in the destructive process forms little lumps or 'tubercles.'

As far as we can ascertain from numerous records which have been made, there has been a great, almost an alarming, increase in the number of animals affected with tuberculosis during recent years. Not only in England, but abroad, this has been the case, and in the interests of agriculture alone there is every reason why efforts should be made to arrest and check the advance of this insidious foe. The annual loss to farmers in Great Britain from this disease must amount to many thousands of pounds, and it is very much greater than those who are not in close touch with the manner and customs of rearing and disposing of cattle in country districts are aware. Apart from this, the fact that tuberculosis can be given by one animal to another, and by domestic animals to human beings, has caused the disease to assume an importance for agriculturists which no other disease has heretofore done.

It is stated that milk from affected cows has given tuberculosis to thousands of children, and that the flesh of affected animals also conveys infection to human beings. For these reasons medical men and others are constantly urging that immediate and drastic steps shall be taken to efficiently inspect our milk and meat supplies.

I am, therefore, giving some figures relating to the disease in human beings so that the importance of the subject to national health may be appreciated, as it seems certain that in the near future tuberculosis will be a scheduled disease and dealt with under the Contagious Diseases (Animals) Act. I consider it of the very greatest importance to agriculture that tentative measures should be adopted by our Board of Agriculture, so that farmers may gradually be prepared for somewhat more stringent regulations, which the public may demand at any time, and which the Board may be compelled to enforce, to the heavy and needless loss of the stock owners of the country.

In man, as everyone knows, consumption of the lungs is by far the most common form in which the disease appears, and causes annually in England and Wales over 40,000 deaths—more deaths, in fact, than are caused by any other disease. It is most fatal between the ages of fifteen and forty-five. This form cannot be shown to be caused by eating tuberculous meat or drinking tuberculous milk, but is due to the contagion spreading from man to man by the inhalation of dust to which is attached particles of dried sputum containing the tubercle bacillus. There are, however, many other forms in which the tubercle bacillus develops in man, and the most important of these, for our present purpose, is consumption of the bowels, or tabes mesenterica. This form occurs in children, and it is but reasonable to suppose that, if there is contagion in the food, the alimentary canal, along which it passes, will become affected by it.

English statistics show that consumption of the lungs in man during the last forty years has diminished by about 37 per cent., which further tends to prove that the eating of meat affected by tuberculosis can have little influence in causing the disease. But statistics over the same period with regard to consumption of the bowels show that there has been no corresponding diminution—that it has diminished, in fact, only by about 5 per cent.—and, consequently, one is driven to the conclusion that there is some cause at work in maintaining this special form of the disease which is not present in the former case. Seeing that cow's milk is the staple food of children, and it has been definitely proved that tubercle bacilli exist in cow's milk when the udder is tuberculous, there is strong presumptive evidence that the cause at work is feeding on such milk. Further, the argument is strengthened when the experimental evidence is adduced which was carried out on lower animals, such as guinea-pigs, for the Royal Commission of 1890. When guinea-pigs were fed on food designedly contaminated with tuberculous matter, only a few of them developed the disease, but when they were fed on milk from tuberculous udders they all became affected. Indeed, so markedly was this the case that the experimenter (Dr. Martin) could only describe the action of such milk as 'virulent.'

The general conclusion from this is, therefore, that too much attention has been paid to the meat from tuberculous animals by local authorities, and too little to the subject of milk.

There can be no doubt that in the past a great quantity of meat has been destroyed by the officers of local authorities which might very well have been eaten, because it has been found that only rarely does the tubercle bacillus lodge in the muscular substance itself, and providing the organs containing the tuberculous deposits are destroyed, the meat itself may be sound.

The tables prepared by the Mutual Life Insurance show the large number of children affected, particularly in London.

DEATHS PER MILLION POPULATION FROM DIFFERENT FORMS OF TUBERCULOSIS.

Form of Disease.	England, 1898.	Scotland, 1898.	London, 1898.	Berlin, 1898.	Paris, 1897.	New York, 1899.	Boston, 1900.	Chicago, 1897-98.
Under 1 Year.								
Tabes mesenterica	104	56	134	2	2	10	4	1
Tubercular meningitis	63	82	88	22	56	79	77	23
Other forms of tuberculosis, scrofula	42	29	63	11	20	22	35	12
Phthisis	16	18	22	44	19	28	20	20
Total tuberculosis	225	185	307	79	97	139	136	56
Under 15 Years.								Under 20.
Tabes mesenterica	177	185	200	16	19	11	18	9
Tubercular meningitis	196	285	261	116	333	216	209	76
Other forms of tuberculosis, scrofula	108	108	154	23	78	66	91	48
Phthisis	100	169	110	203	182	102	93	214
Total tuberculosis	581	747	725	358	612	395	411	347
Under 25 Years.								Under 30.
Tabes mesenterica	186	205	206	20	24	11	21	11
Tubercular meningitis	205	297	269	122	355	224	219	83
Other forms of tuberculosis, scrofula	135	142	176	26	138	92	141	76
Phthisis	357	629	337	556	778	493	567	630
Total tuberculosis	883	1,274	988	724	1,295	820	948	800
All Ages.								
Tabes mesenterica	202	223	221	40	61	13	32	17
Tubercular meningitis	213	303	278	134	398	243	234	90
Other forms of tuberculosis, scrofula	184	192	218	50	465	173	322	141
Phthisis	1,317	1,668	1,734	2,009	3,702	2,258	2,223	1,406
Total tuberculosis	1,916	2,386	2,451	2,233	4,626	2,687	2,811	1,654

DEATHS FROM TUBERCULOUS DISEASES IN ENGLAND AND WALES FOR THE YEAR 1898.

(POPULATION 31,397,078.)

Form of Disease.	Under 1 Year.	Under 5 Years.	Under 10 Years.	Under 15 Years.	Under 20 Years.	Under 25 Years.	Under 35 Years.	All Ages.
Tabes mesenterica - -	3.265	5,050	5,369	5,555	5,725	5,850	6,050	6,357
Tubercular meningitis (acute hydrocephalus) -	1,985	4,904	5,791	6,147	6,339	6,451	6,573	6,681
Other forms of tuberculosis, scrofula -	1,319	2,585	3.035	3,399	3,851	4,233	4.807	5,766
Total other than phthisis	6,569	12,539	14,195	15,101	15.915	16,534	17,430	18,804
Phthisis -	493	1,491	2,126	3,127	6,437	11,212	21,007	41,335
Total tuberculosis -	7,062	14.030	16,321	18,228	22,352	27.746	38,437	60,139

DEATHS FROM TUBERCULOUS DISEASES IN SCOTLAND FOR THE YEAR 1898.

(POPULATION 4,249,956.)

Form of Disease.	Under 1 Year.	Under 15 Years.	Under 25 Years.	All Ages.
Tabes mesenterica - -	239	788	872	947
Tubercular meningitis - -	350	1,212	1,263	1,288
Other forms of tuberculosis, scrofula - - - - -	121	459	605	815
Total other than phthisis	710	2,459	2,740	3,050
Phthisis - - -	78	720	2 675	7,090
Total tuberculosis - -	788	3,179	5,415	10,140

Although these statistics may not be absolutely reliable, yet an examination of the results of numerous postmortems made by independent observers in different cities show that they are fairly accurate, and if they err at all it is in understating the number of deaths.

The opinion of a large number of investigators is that tabes mesenterica, or tuberculous disease of the digestive system, is produced by the food which is taken being diseased, and as the great majority of these cases occur during the first two years of a child's life, while it is being fed on cow's milk, it has caused suspicion to fall on the cow. This has led to experiments which have proved that milk from cows affected with tuberculosis will, in certain cases, cause the death of calves, pigs, guinea-pigs, and other animals; and although experimenters have not published any reports on feeding children as they have other animals, we can only reason from circumstantial or clinical evidence that, as such milk kills these other animals, and as children when feeding on cow's milk are particularly liable to the disease, it must, in some cases, at least, be caused by the milk.

In glancing at the above statistics the striking differences in the number of cases affected at different ages is clearly shown. The much larger number of children which die in London compared with Berlin, Paris, New York, Boston, and Chicago, is appalling. This high death-rate may not be entirely due to defects in our milk-supply, although those who know how cattle until recently were kept for milk in London, compared with these other cities mentioned, would not be surprised at the results. There may be other causes, such as climate, housing, and perhaps a more extended use of the bottle for feeding the children; but as the total death-rate in other cities is as great as it is in London, it must be considered that the number of tubercle bacilli in the air are as numerous in one place as another.

We must inquire also that as tuberculosis is so widely spread among human beings, may they not always constitute a danger to our cattle? and can we hope to get rid of the disease from our herds while human beings are affected? An extract from a paper written by Dr. A. Newsholme, Medical Officer of Health for Brighton, gives his view after years of practical work.

He says two ends are aimed at, and there need be no quibbling as to their relative importance. The first is to fortify each member of the community against the disease when he is invaded by its active cause, the tubercle bacillus. The second is to protect each member of the community against the invasion of the tubercle bacillus. I have already indicated my belief that many of the reforms that are supposed to have operated in the first direction, especially improvements in housing and cleanliness, have also operated still more in the second direction. A difference of opinion as to the *modus operandi* need not prevent combined action in the struggle against tuberculosis in each direction. The encouragement of treatment in sanatoria, and still more of training in sanatoria, on which I have laid stress, is ideal in this respect. Such training teaches the patient the importance of the fortifying influence of an outdoor life, of sunshine and of general hygiene, including a personal condition of high nutrition. It also teaches him the importance of the careful and cleanly control of his expectoration, in the interest of himself and his friends. In the next twenty years we shall have not only steady improvement in general sanitation, but, in all probability, the notification of every case of phthisis, with efficient measures of disinfection and cleansing, and such an extension of sanitorium treatment as has hitherto appeared to be impracticable. And it is not difficult to foresee that along with the general adoption of these measures will come a reduction of tuberculosis at a rate much more rapid and extensive than has hitherto been secured. There is, I believe, more hope of the almost complete extermination of tuberculosis than any of the acute infectious diseases, with the possible exception of typhus and small-pox.

A system of voluntary notification of the disease in human beings has been adopted at Brighton, Manchester, and Sheffield, and the medical officers take steps to remove patients to sanatoria, disinfect their houses, and teach them how to prevent spreading the infection to other people. This information, although only voluntary at present, will probably become compulsory, and will then be used as a means of watching and inspecting the milk-supply of these towns.

The following table shows close coincidence between the price of wheat and the phthisis death-rate. The reasons for this coincidence are not far to seek. The more abundant and cheaper supply of food has doubtless improved the physical condition of the population, and made them less susceptible to the inroads of tuberculosis. It is not, however, simply and solely a question of cheaper food. The English population, as a whole, has increased its standard of comfort, and has been able to afford not only better, more abundant, more varied, and more wholesome food, but it is also better clad and better housed than it has been in the past. In 1861 a penny on the income tax yielded £1,100,000, in 1901 it yielded £2,400,000, an increase of 118 per cent., while the population of Great Britain only increased 43⅓ per cent. in the interval.

AVERAGE PRICES OF WHEAT AND PHTHISIS MORTALITY.

Years.	Prices of Wheat per Quarter in Pence.	Death-rate per Million of Population from Phthisis.	Proportional Amounts in each Quinquennium. Average for Entire Period = 100.	
			Wheat.	Phthisis.
5 years 1838-42 ...	775·6	3,880	141	172
(No statistics as to the cause of death were kept 1843-49 inclusive.)				
5 years 1851-56 ...	668·6	2,851	121	126
,, 1856-60 ...	640·0	2,603	116	115
,, 1861-65 ...	568·0	2,528	103	112
,, 1866-70 ...	655·6	2,448	119	108
,, 1871-75 ...	655·6	2,218	119	98
,, 1876-80 ...	570·0	2,040	103	91
,, 1881-85 ...	481·2	1,830	87	81
,, 1886-90 ...	376·8	1,635	68	72
,, 1891-95 ...	334·8	1,461	61	65
,, 1896-1900	343·0	1,321	62	59

CHAPTER II

CAUSE OF TUBERCULOSIS

ALTHOUGH tuberculosis has only been recognised among agriculturists as a specific disease during the last few years, dairy farmers have seen and recognised its ravages in their herd for a long time, but have not been able to appreciate its cause. Animals suffering from tuberculosis were supposed to be affected with various distinct diseases, and many local names, such as grape disease, pearl disease, wasters, piners, snorters, have been given, according as the lungs, bowels, or glands of the throat were attacked. Many cases of so-called wens or clivers, and of hard swellings in the udder setting up mammitis, were attributed to different causes, but according to present knowledge, they should all be included under this one heading of tuberculosis.

In pigs it is generally called 'wasting,' from the very prominent symptom which it produces. Frequently it has been mistaken for swine fever or a cold, and in hundreds of cases pigs have died from it without any attempt having been made to ascertain the cause of death.

While cattle and pigs contract the disease easily, horses and sheep are only occasionally affected with it. Dogs and cats contract the disease, and probably more are affected than is commonly supposed; while birds and wild animals when kept in confinement are all subject to its ravages.

It is, however, chiefly among cattle that are used for dairy purposes, and which are housed for a considerable portion of the year, that tuberculosis exists. The symptoms which are observed in cattle vary to a certain extent, according to the portion of the body where the disease exists. In many cases an animal may be extensively affected with tuberculosis without showing external symptoms of the disease. In other cases, a very rapid loss of flesh is observed, quickly resulting in death.

From observations and experiments that have been made, there seems little doubt that tuberculosis is not frequently met with among those breeds of cattle which are usually kept out of doors, while, on the other hand, those breeds which have been kept indoors in warm cow-sheds, and which have been forced for the production of milk, are affected with the disease to a very great extent. The shorthorns, Ayrshires, Jerseys, and Guernseys are the breeds of cattle in which the disease is most prevalent. No doubt, if any other breed of cattle was placed under the same conditions which have prevailed for the last few years in the management of the shorthorns, Ayrshires, Jerseys, and Guernseys, it would become quite as badly affected with tuberculosis as those already mentioned. Amongst dairy cattle at the present time it has been estimated that at least 25 per cent. are more or less diseased. This estimation has been made as the result of post-mortem examination of herds of cattle which have been slaughtered under the pleuropneumonia regulations, and as the result of observations made at public slaughter-houses. Where the tuberculin test has been used, to which reference is made later, the percentage of animals affected is considerably higher.

Professor MacFadyean states that in 1899, out of 1,175 animals tested for tuberculosis in Cornwall, Devon, Dorset, and Somerset, 84, or 7 per cent., reacted ; while during the same year out of 2,090 cattle tested in other counties 698, or 33 per cent., reacted. He says, in explaining these remarkable inequalities, that the conditions under which the animals live have probably more to do with this difference in percentage than either climate or breed. This view I share, through the experience I have had in farming for some years in both the East and West of England. In the West of England our cattle are out of doors for a much greater portion of the year than they are in other parts.

Dr. Robert Koch in 1883 discovered that tuberculosis was due to the presence of a very small germ, or fungus, which invaded the animal tissues, and in the tissues in which the fungus developed little round nodules, or tubercles, were formed. He found that a number of these germs, or bacteria, as they are called, would only grow under certain definite conditions, and that in the main they were very much like plants of a larger growth with which we are more familiar. The germs of the disease, or, to speak more correctly, the tubercle bacilli, belong to the lowest form of plant-life. When viewed under the microscope, the bacillus has the appearance of a little rod. As soon as it had been found that these bacilli were present in all the tubercles, it became necessary to ascertain whether they were the actual cause of the disease, or only happened to grow after the disease had become established. To determine this point, some of these bacilli were grown in glass tubes containing a mixture of gelatine and broth, and were kept in them at a regular temperature of about 99° F. for some weeks. On this nutrient medium the bacilli grew, and after a time the appearance they presented was that of a gray membrane extending over the surface. Some of them were then taken from these glass tubes and planted in other glass tubes and grown under similar conditions. This was repeated a number of times, so that there was no possibility of any other bacilli being present in the last tubes. A crop of bacilli from one of the last tubes was then taken and introduced into the body of a healthy animal; in some cases they were injected under the skin, in other cases into the veins or abdomen, and in others, again, they were mixed with the food given to the animals. The result was that in the course of a short period the animals thus inoculated became affected with tuberculosis, and when they were killed and a post-mortem examination made, tubercles were found to have developed in various parts of their bodies containing the same sort of bacilli which had been first taken from another animal's body some months, or even longer, before.

These experiments established the fact that the bacilli are the cause of tuberculosis. They further show that the disease is of a contagious nature; that wherever these bacilli are planted, if the conditions be suitable, they will take root, grow, multiply, and cause disease.

Following up this argument, it will be readily seen that it is quite possible for an animal affected with tuberculosis of the lungs to cough out the bacilli over its own or some other animal's food, and the food when swallowed will carry the bacilli into the digestive organs and infect the bowels or mesentery. An analogy may help to explain the meaning of the greater susceptibility to tuberculosis of one class of animal than of another. Everyone knows that both Indian corn and wheat are grown in England. Wheat, as is known, readily matures and produces heavy crops. It is also known that acres of Indian corn may be grown, and it will reach a height of 6 feet and more; but it is only in exceptional years that in England it is possible to count upon getting a crop of maize. The climate is such that it does not ripen quickly or easily. At the same time, occasionally some very fine heads of Indian corn may be obtained, and the reason for the difference in the results is that there is something in the habit of growth of the two corns which enables the one to produce a crop where the other cannot. But if the Indian corn is grown in America, it finds there a congenial climate, which assists it in producing abundant and heavy crops of the ripened corn. Much the same thing is found with regard to the tubercle bacilli. The bacillus is the seed, and the animal body the soil. But the seed and soil alone are insufficient to produce crops. There must be warmth, moisture, and general suitability. These agents are spoken of as accessory causes, and in the development of tuberculosis they are of the very greatest importance. For instance, animals of a hardy constitution which live out of doors may take in a considerable number of the tubercle bacilli without being affected by them. The condition of the tissues of their bodies is such that it is uncongenial to the growth of the bacilli. The following are among the chief accessory causes:

Heredity.—Until very recently it was generally asserted that the principal influence or cause was heredity. At the present day it is quite as strongly asserted that heredity has little or nothing to do with the spread of the disease. Although heredity cannot be said to be the actual cause of the disease, yet it is impossible to doubt that it exerts an important influence on its propagation. There are some families of animals the tissues of which form a favourable seed-ground for tuberculosis, and if any of the bacilli effect an entrance they will grow quickly and luxuriantly, the animal having little or no protective power in its own body. On the other hand, there are members of other families, exposed to the same infection and under the same conditions, which are able to resist the disease to a very marked extent.

Sire.—In heredity, the question arises what influence the sire possesses, and what influence the dam. If the sire is tubercular, is there a likely prospect of his communicating the disease either to the dam or to the offspring? A careful examination of the evidence on this point leads to the conclusion that there is very little danger, if any, of the disease being communicated by the sire to either the dam or the offspring. A tubercular bull might, when in contact with a cow, infect her; but practical experience shows that such an event is highly improbable, and is not an important factor. It is even less likely that a bull could infect a calf at the period of service. The influence a sire has on the disease is that derived from the power he has to perpetuate and to reproduce the particular form, colour, shape, and peculiarities of tissues which his individuality may possess.

Dam.—It also seems probable that there is very little danger of the disease being communicated from the cow to the calf before birth; and although it is quite conceivable that where a cow is the subject of generalized and progressive tuberculosis the fœtus may become infected before birth, it must be at some period after the development of the ovum has commenced, and in any case it is an extremely rare occurrence.

The part which heredity plays in the propagation of this disease seems to consist in the perpetuation of constitutions favourable to the growth of this particular bacillus when introduced.

Climatic Influence.—Climate undoubtedly has a direct influence, and the purer the air is, the less chance is there for the development of the tubercle bacilli; indeed, in mild cases of tuberculosis there are particular districts where the air exerts a curative effect on the disease, such, for example, as the climate of the High Alps and the Highlands of South Africa. But in no climate, so far as is known, can the disease originate spontaneously.

Geological Conditions.—It has been asserted that tuberculosis is due to a large extent to the soil. This does not seem to be the case, as the disease is found equally prevalent on primary, secondary, and tertiary formations. It is found alike on clay, gravel, or sandstone.

Influence of Food.—As an accessory cause or favouring circumstance food plays a large part, and animals fed on stimulating or forcing food, particularly such foods as brewers' grains, are rendered more susceptible to all diseases, including tuberculosis.

Housing.—What statistics there are show very clearly that animals kept in houses are more liable to tuberculosis than those living an open-air life, and this is very much more the case when the animals are kept in small, dark, badly-ventilated sheds. In dark sheds the tubercle bacilli will live for weeks or months, perhaps even longer, and they are carried about in the dust ready to cause disease. Exposed to the sunlight for a few hours, the bacilli are killed and rendered harmless. Badly-ventilated sheds cause a great accumulation of foul gases, given off from the animal's body and lungs, which are necessarily rebreathed many times, and cause a lowered vitality of the tissues. The air must be continually changed, so that an animal can at every breath take in pure air, and not air plus injurious gases. In order to change the air constantly, and yet prevent a continuous rush that would cause a draught, it is necessary for the buildings to have sufficient air space.

The exact amount of air space that is beneficial must vary a little according to the size of the animal, the position and structure of the building, and the amount of ventilation. A safe guide to take in cases where the sheds are isolated and free from other buildings is a minimum air space corresponding to 1 cubic foot for each pound weight of the animal's body, but in towns or places where the sheds are shut in by other buildings a minimum air space of not less than 800 cubic feet should be given.

Where tuberculous cattle have been tied up in one stall for a number of years, the woodwork, the mangers, and the walls become so thoroughly infected with the tubercle bacilli that healthy animals tied up in the same place months afterwards will contract the disease.

Contagion.—The great—in fact, the only—means by which tuberculosis is spread is contagion, principally from the dust contained in the air inhaled, or from the food which is eaten. And it must be remembered that it is not necessary for animals to be in direct contact to communicate the disease.

Another means which has been advanced as propagating the disease is contact with human beings, and there is no doubt that some of the men who are employed in stalls in which cows are kept all the year round, and in which the ventilation is defective, are themselves tubercular. It is only reasonable to suppose that in some cases these men can infect animals. But it is improbable that this is so to any large extent, particularly as the tubercle bacilli which have grown in the human body seem to lose part of their virulence or power to affect cattle.

CHAPTER III

SYMPTOMS AND DIAGNOSIS OF THE DISEASE

HAVING admitted, then, that a large number of animals are affected, and that the disease is one which is practically only spread through contagion, though influenced by heredity, food, housing, and climate, the next point to consider is whether any practical means can be devised for eliminating the disease, or, at any rate, for keeping it within much smaller limits than is the case at present.

The first step in the problem is to diagnose the disease correctly.

Physical Symptoms.—In only a small proportion of the animals that are actually affected with tuberculosis is it possible, by a physical examination, to diagnose the disease correctly, and this has been the great stumbling-block hitherto in the way of dealing with the disease. There are no absolutely diagnostic symptoms which are usually found present in the various forms assumed by the disease, for nearly all the symptoms may arise from some other cause, and it is necessary from circumstantial evidence to balance between the most likely probabilities. In cattle there are acute and chronic forms of the disease which may emerge or change into each other. In the acute form the symptoms vary with the organ or organs that are chiefly attacked; but one symptom always present is a high temperature—105° to 107° F.—with quick respirations and accelerated pulse-beat. If the lungs are involved, auscultation will reveal it. They quickly become congested, and air is prevented from passing to the smaller bronchi and air vesicles. The abdominal respiratory movements are shallow, quick, and often twice as rapid as usual, while the elbows are markedly turned out. There is glistening and brilliancy of the eye, a dry nose, and disinclination for food. Death is the usual sequel within the course of a few weeks. In the chronic form there are frequently no physical manifestations of the disease, and considerable portions of various organs may be affected for months or years without apparent inconvenience to the animal. In some chronic cases it is frequently noticed that other illnesses, such as difficulties during parturition or colds, are materially aggravated, and are more difficult to treat. In others a gradual manifestation of symptoms is observed, dependent on a disturbance of the functions of the body, brought about by the tubercular growths. When the mesenteric glands are affected, nutrition is impaired, and. in spite of the best food and nursing, the animal gradually wastes away until it dies.

Where the lungs are involved, shortness of breath and a chronic cough are generally the leading features. It is, however, a curious fact, which has been repeatedly noticed, that although large portions of the lungs may have become completely solidified through the disease, and enormous tubercular nodules be present on the pleura, the animal has remained in a nearly fat condition for years, and the existence of the disease only been discovered after slaughter in the ordinary trade way for human food. It must not be assumed that because this is the case in some individual animals the chronic form of the disease is not serious. In most cases the disease progresses, and though it may do so slowly, there usually comes a time when physical symptoms are manifested and the animal depreciates in value. There is also the danger that the disease may be communicated to other animals and set up the disease in an acute form.

In young stock the glands of the throat are sometimes the seat of the disease, showing its presence by hard, deep-seated swellings at the junction of the head and neck. After a time the swelling forms an abscess, but still remains hard, and does not yield to treatment.

When the udder is affected, the swelling generally appears as a small, marble-like nodule in one quarter, which gradually extends until the whole quarter is involved and useless for milk-secretion. The other quarters may also become affected. In some cases there is no disturbance of the general health of the cow; in others the attack may be acute, showing itself by feverish symptoms.

In cases of heavy milking-cows it frequently happens that when there is an acute attack of tuberculosis of the udder, the suffering and pain are so great that death results very quickly.

In pigs the symptoms manifested are a markedly unthrifty condition, often accompanied by an erratic appetite. There is almost invariably a cough and a tendency to diarrhœa. Many of the outbreaks occur on dairy farms, and often large numbers of pigs are attacked. It spreads easily from one pig to another, and the sties become so contaminated with the disease that it is unsafe to put healthy pigs into them until they have been thoroughly disinfected. Pigs are generally affected in the lungs, spleen, and liver, and brood sows which are diseased become affected in the udder, and some give the disease to their offspring. Unfortunately, so few people know that pigs are affected in this way, that often large herds are decimated, while the survivors are sold off as being ‘an unthrifty lot,’ to spread disease among neighbouring herds. I knew one case where a brood sow from an infected herd was sold to a neighbouring farm, with the result that within a few months seventy pigs on that farm had become diseased.

The disease, fortunately, does not occur very frequently in other domestic animals. In horses and asses it occurs, and the symptoms are generally the same as those observed in pigs, except that the disease is not in such an actively infectious form. Although they are subject to infection, their open-air life has so far prevented many cases.

Both cats and dogs are subject to the disease, and too great caution cannot be employed in allowing children to play with pampered pets when they seem unwell, particularly if they cough or appear to be out of sorts.

By constant practice these symptoms become valuable aids to diagnosis, but there is not sufficient evidence in them to make the diagnosis certain.

Recently a new substance has been discovered which promises very material aid in dealing with the disease. It is made by growing large numbers of the tubercle bacilli in an incubator, and from them preparing a very powerful substance called tuberculin. When a correct dose of tuberculin is injected into the body of a tuberculous animal, it causes a good deal of feverish disturbance, and if the temperature of the animal be taken during the twenty-four hours succeeding the injection of tuberculin, it will be found to have risen several degrees (see Tables I. and II.). If, on the other hand, the animal is healthy, the injection of tuberculin causes no appreciable effect. At first it was hoped that the repeated injection of tuberculin might cure the disease, but at present this has not proved to be the case. Possibly some modification in the preparation of tuberculin may be discovered which will have that desired result. Tuberculin must be regarded merely as a means of diagnosing the disease, and it therefore becomes a serious matter to ascertain to what extent the test is a reliable and practicable one.

CHAPTER IV

THE RELIABILITY OF THE TUBERCULIN TEST

THE importance to agriculture of knowing to what extent the tuberculin test was reliable was so great that the Royal Agricultural Society of England appointed a committee, consisting of Lord Brougham and Vaux, Sir Nigel Kingscote, Sir George T. Brown, and Professor MacFadyean, to inquire into and report on the reliability of the tuberculin test. I am quoting this report somewhat fully, as the data it gives is very exact, and the fact that it is made for the Royal Agricultural Society should particularly commend it to the consideration and confidence of stock owners all over the world. It is too lengthy to quote *in extenso*, so I have extracted what seems to be some of the most useful of the experiments :

ANIMAL NO. 17.

		Reaction.	*Maximum Rise.*
Jan. 24.	Tested with 1 c.c. tuberculin ..	—	1·4
Feb. 6.	Fed with tuberculous material.		
,, 14.	Tested with 1 c.c. tuberculin ..	—	0·8
,, 21.	,, ,, ..	—	0·6
,, 28.	,, ,, ..	—	0
Mar. 15.	,, ,, ..	—	1·3
Apr. 9.	,, ,, ..	—	0·9

Killed April 10. No lesions discovered.

Animal No. 18.

		Reaction.	*Maximum Rise.*
Jan. 24.	Tested with 1 c.c. tuberculin ..	—	0·1
Feb. 6.	Fed with tuberculous material.		
,, 14.	Tested with 1 c.c. tuberculin ..	+	4·4
,, 17.	,, ,, ..	+	2·1
,, 21.	Tested (erratic rise at 6th hour)	?	3·2
,, 24.	Treated with 5 c.c. tuberculin	+	5·4
,, 28.	,, 10 c.c. ,,	+	2·4
Mar. 3.	,, ,, ,,	+	5·4
,, 8.	,, ,, ,,	+	2·3
,, 15.	,, ,, ,,	?	1·9
,, 28.	,, 20 c.c. ,,	?	1·3
Apr. 9.	Tested with 1 c.c. ,,	—	0·8

Killed April 10. *Lesions*—Numerous tubercles in the mucous membrane of the small intestine.

Nos. 17 and 18, as regards the dose of infective material and the method of its administration, were exactly parallel experiments, and they yielded results which are, from several points of view, very interesting and instructive. No. 17 did not become infected, although it received a quantity of infective material such as it can scarcely ever be the lot of an animal of the bovine species to take into its body at one time, exception being, perhaps, made of calves receiving undiluted milk from a tuberculous udder. That is the first point of interest. The second is that the tuberculin test correctly indicated that the attempt to infect had failed.

The facts relating to No. 18 are no less interesting. Here the attempt to infect succeeded, and the first tuberculin test afterwards, which was made on the eighth day, elicited a most pronounced reaction. It may safely be asserted that had the animal been killed on that day no trace of disease would have been discoverable with the naked eye, and had the date of infection not been known the case would have appeared to be one of failure of the tuberculin test.

It will be observed that for over a month No. 18 was treated with large doses, but although the post-mortem examination indicated that the disease had remained confined to the bowel wall, it might be rash to conclude that it would have spread further had the animal not been treated with tuberculin.

Fourth Series.

The following ten animals formed one lot of eighteen months old shorthorns purchased for experiment on May 2, 1900. They were all in good condition, and quite healthy-looking; but the preliminary test with tuberculin on May 15 indicated that four of them (Nos. 19 to 22) were already the subjects of tuberculosis. They were killed on May 22, and the post-mortem examination revealed in each of them distinct tuberculous lesions of considerable standing. The following are the particulars relating to these four animals:

Animal No. 19.

		Reaction.	Maximum Rise.
May 15.	Tested with 2 c.c. tuberculin ..	+	3·6
,, 21.	,, ,, ..	—	0·5

Killed May 22. Tuberculous lesions in several mesenteric glands, peritoneum, lungs, and mediastinal glands.

Animal No. 20.

		Reaction.	Maximum Rise.
May 15.	Tested with 2 c.c. tuberculin ..	+	6
,, 21.	,, ,, ..	+	3·9

Killed May 22. *Lesions*—Tubercles in two mesenteric glands.

Animal No. 21.

		Reaction.	Maximum Rise.
May 15.	Tested with 2 c.c. tuberculin ..	+	6
,, 21.	,, ,, ..	—	1

Killed May 22. *Lesions*—Tubercles in bronchial gland.

Animal No. 22.

		Reaction.	Maximum Rise.
May 15.	Tested with 2 c.c. tuberculin ..	+	3·7
,, 21.	,, (somewhat erratic rise) ..	?	2·8

Killed May 22. *Lesions*—Tubercles in pharyngeal gland.

In these four cases the post-mortem examination proved the correctness of the indication afforded by the first test with tuberculin. A further point of interest in connection with them is, that the second test, six days after the first, would have acquitted two of them of any suspicion of tuberculosis had it not been known that they had previously been tested.

The following six animals were purchased on May 2, tested without reaction on May 15, experimentally infected with tuberculous material on May 28, and afterwards tested with an ordinary dose of tuberculin at intervals in order to ascertain how soon each would react. The method of infection was as follows: Pieces of caseous matter from the tuberculous lung and lymphatic gland of a cow, to the volume of a hen's egg, were rubbed up in a mortar with 3 pints of water, and ½ pint of this liquid was administered to each animal by the mouth.

Animal No. 23.

		Reaction.	Maximum Rise.
May 15.	Tested with 2 c.c. tuberculin ..	—	0·5
,, 28.	Fed with tuberculin material.		
,, 31.	Tested with 2 c.c. tuberculin ..	—	0·4
June 21.	,, ,, ..	+	3·8
July 7.	,, ,, ..	+	4·0
,, 18.	,, ,, ..	?	1·4

Killed July 19. Tubercles in pharyngeal and mesenteric glands.

Animal No. 24.

		Reaction.	*Maximum Rise.*
May 15.	Tested with 2 c.c. tuberculin ..	—	0·5
,, 28.	Fed with tuberculous material.		
June 6.	Tested with 2 c.c. tuberculin ..	—	0·6
,, 24.	,, ,, ..	—	0·2
July 7.	,, ,, ..	+	4·4
,, 18.	,, ,, ..	+	3·8

Killed July 19. Tubercles in three mesenteric glands.

Animal No. 25.

		Reaction.	*Maximum Rise.*
May 15.	Tested with 2 c.c. tuberculin ..	—	1·6
,, 28.	Fed with tuberculous matter.		
June 10.	Tested with 2 c.c. tuberculin ..	—	0·4
,, 24.	,, ,, ..	—	0·4
July 7.	,, ,, ..	—	0·4
,, 18.	,, ,, ..	+	3·2

Killed July 19. Tubercles in two mesenteric glands.

Animal No. 26.

		Reaction.	*Maximum Rise.*
May 15.	Tested with 2 c.c. tuberculin ..	—	1·8
,, 28.	Fed with tuberculous matter.		
June 3.	Tested with 2 c.c. tuberculin ..	—	0·6
,, 24.	,, ,, ..	—	1·8
July 7.	,, ,, ..	—	0·3
,, 18.	,, ,, ..	+	2·6
,, 26.	,, ,, ..	+	3·4

Killed July 28. Tubercles in four mesenteric glands.

Animal No. 27.

		Reaction.	*Maximum Rise.*
May 15.	Tested with 2 c.c. tuberculin ..	—	1
,, 28.	Fed with tuberculous matter.		
June 13.	Tested with 2 c.c. tuberculin ..	—	0·1
July 7.	,, ,, ..	+	2·8
,, 18.	,, ,, ..	+	2

Killed July 19. Tubercles in pharyngeal gland.

Animal No. 28.

		Reaction.	*Maximum Rise.*
May 15.	Tested with 2 c.c. tuberculin (erratic rise)	?	2·7
,, 28.	Fed with tuberculous matter.		
June 17.	Tested with 2 c.c. tuberculin ..	—	0
July 7.	,, ,, ..	+	3·8
,, 18.	,, ,, ..	+	2·7

Killed July 19. Tubercles in pharyngeal gland.

It will be observed that some of these animals, except No. 28, reacted to the first test after purchase. In the case of No. 28 the temperature rose 2·7° F., but the course was irregular, and the case had to be considered doubtful. After the administration of the tuberculous material all the animals acquired the power of reacting, but the considerable period that elapsed before a reaction could be obtained is somewhat remarkable. This period was longest in No. 26, which entirely failed to react on the fortieth day, but did react on the fifty-first day, and again on the fifty-ninth day. It is impossible, in the present state of knowledge, to account for this peculiar fact, but it may be pointed out that it was certainly not due to the actual infection—that is to say, the penetration of the bacilli into the tissues—having been delayed, for in all these animals the appearance of the lesions found at the post-mortem examination indicated that they must have been in existence for several weeks, and, indeed, were in keeping with the view that they had come into existence very soon after the administration of the infective material on May 28. It has for some time been well known that a first reaction in a tuberculous animal may prevent one from obtaining a second decided reaction when the test is repeated soon afterwards, and a good many examples of that are seen in the series of experiments here recorded. It appears to be possible that injections of tuberculin during what may be termed the period of incubation of the disease may have a like effect, although they do not elicit a reaction. If that explanation of the delayed reaction in these cases be rejected, then one would have to admit that in perfectly natural circumstances an animal that had contracted the seeds of the disease might, even with the tuberculin test, pass for healthy for a period of six or seven weeks.

Finally, in connection with this lot of animals, it ought to be mentioned that none of the lesions had an appearance indicating that they must have been in existence when the cattle failed to react to the first test on May 15.

These experiments very fully support many others which have been made, which show that after an animal has become infected with tuberculosis a period varying from eight to fifty days elapses before it is possible to obtain a reaction to the tuberculin test.

Since these experiments were carried out, a French veterinary surgeon, Professor Vallée, has described a method by which it appears that an animal may be retested within a couple of days of the first test with correct results. He says that by giving a double dose of tuberculin, and by taking the animal's temperature, every two hours from the second hour after injection until the sixteenth, a correct diagnosis can be made. It is too early yet to say if this will prove correct in all cases and under all conditions; but if it does—and there appears reason to think it will—it affords a most valuable means of testing pedigree animals for export, and may materially lessen the time that such animals now have to spend in quarantine.

With regard to the preparation of tuberculin, Dr. Roux writes to me that 'The tuberculin which is made at the Pasteur Institute is sent out under two forms: strong, and by preference diluted, ready to be injected. The strong tuberculin is obtained by concentrating to one-tenth of their original volume cultures of tubercle bacilli in bouillon glycerine about six weeks old. The diluted tuberculin is made by the addition of nine times its own volume of water to the strong.

'Tuberculin cannot cause *any disease*, because, strong or diluted, it is sterilized before being sent out. It can be kept several months in darkness without its activity being diminished.'

Similar processes are employed at other laboratories where tuberculin is manufactured, a prolific growth of tubercle bacilli being obtained on glycerine bouillon, and after its vitality and purity has been ascertained, it is used in quantities of from 1 to 2 c.c., but a larger dose could be used equally well, and without any ill effect. There is no method of standardization, and the tuberculin is prepared from original cultures, from human beings, cattle, or other animals. We know that the virulence of different cultures varies greatly, and it is quite possible that the tuberculin in commercial use is not always reliable, as it may have been prepared by many different people, some of whose methods may not be as accurate as others. This is one reason why I have for years strongly urged that it is the duty of the Board of Agriculture to help stock owners by regulating the sale of tuberculin in England. There are many places where tuberculin can be obtained. In England Professor MacFadyean, the Dean of the London Veterinary College, has devoted great attention to the subject, and issues a tuberculin which, during the last few years, I have generally used with reliable results.

Some years ago I had the opportunity of testing three herds of about 150 cows. The tuberculin was obtained from the Pasteur Institute in Paris in one consignment. The same syringe was used, the same thermometers, and the cows were injected on succeeding nights. In one herd about 40 per cent. of the animals were found to react to the test; in the other two no animal gave a reaction. In the first herd tuberculosis was known to have existed in the sheds almost, if not quite, from the time that they were built. The animals were kept in day and night, there was very little ventilation, and on entering the cowsheds after the workmen had left of an evening, they were exceedingly hot, close, and had a strong smell. In the other herds, the ventilation was good, the sheds roomy, and the cattle had lived open-air lives. So far as could be ascertained, tuberculosis had not been previously found among the stock. There is no way of explaining the action of the tuberculin in these cases, except by accepting the results as a correct diagnosis. In addition to these testings, thousands of others have been carried out with similar results. Particular attention should be paid, however, to those carried out by Professor Dewar on the Castle Craig herd of Sir T. D. Gibson-Carmichael, the results of which I have been allowed to append (see Table on pp. 34-37).

It will be seen that those cattle which reacted to the tuberculin test did so on each subsequent occasion that they were tested, and Sir T. D. Gibson-Carmichael has found that the post-mortem examinations made on his herd have proved the test to be reliable.

During two years which I spent in North and South America, I made numerous inquiries regarding the practical use of tuberculin, and an extract from the 1903 report of Dr. Rutherford, the Chief Veterinary Inspector of Canada, is instructive. He says:

'Very little testing of grade or dairy cattle has been done this year; 389 head were tested in all, of which 83 reacted. As the results of this work in former years had not been found at all satisfactory, a circular on the subject, issued by the Department in December, 1901, contained a notice that no testing of cattle, except for export, would be done between March 1 and October 1. Since the latter date a few applications have been received, and as the regular officers have been fully employed, an arrangement has been reached whereby, upon an applicant stating the number of his cattle, and sending in the name of a reputable, qualified veterinary surgeon, the latter is furnished, free, with sufficient tuberculin to test the cattle in question, on condition that he reports to the Department the result of the test on charts provided for the purpose.

'I would, however, strongly recommend the adoption, as soon as possible, of a system of permanently marking all animals reacting to the tuberculin test, when applied by officers acting under the authority of the Department.

'The present method of dealing with these animals is very unsatisfactory.

'The testing in Britain of cattle for export to Canada is fully dealt with in the report of Dr. Hopkins, who

RESULT OF THE TUBERCULIN TEST ON THE CASTLE CRAIG HERD.

(*Extracted from 'The Use of Tuberculin,' by J. Wilson, Fordyce Lecturer in Agriculture, Aberdeen University.*)

It will be noticed in examining this table that the numbers are grouped according to the cow's family, and that there are very few instances in which more than one member of a family have been affected.

	Temperatures, March, 1895.				Temperatures, January, 1896.				Temperatures, November, 1896.			
	At inoculation.	10½ hours after.	16½ hours after.	19½ hours after.	At inoculation.	9 hours after.	15 hours after.	18 hours after.	At inoculation.	9 hours after.	15 hours after.	18 hours after.
1. Calved 1888 - - -	**103·8**	**106·7**	**104·5**	**102·8**	—	—	—	—	—	—	—	—
65. Calved 1894, dau. of 1 -	—	—	—	—	102·5	101·5	101·7	101·8	101·3	102·5	101·6	101·4
2. Calved 1887 - - -	**102·0**	**107·0**	**104·8**	**104·4**	—	—	—	—	—	—	—	—
3. Calved 1887 - - -	101·0	102·2	101·0	101·0	102·1	101·2	101·1	100·9	101·3	101·0	101·0	101·0
23. Calved 1893, dau. of 3 -	101·9	101·4	101·4	100·9	101·4	101·7	101·7	101·7	102·2	101·3	101·3	101·3
98. Calved 1895, son of 23	—	—	—	—	—	—	—	—	103·1	102·2	101·7	101·5
66. Calved 1894, dau. of 3 -	—	—	—	—	102·5	101·6	101·7	101·0	102·3	102·2	102·0	102·2
52. Calved 1895, son of 3 -	—	—	—	—	103·4	104·0	104·2	103·2	—	—	—	—
100. Calved 1896, son of 3 -	—	—	—	—	—	—	—	—	102·6	101·8	101·7	102·8
5. Calved 1878 - - -	**100·2**	**104·7**	**104·5**	**102·8**	**102·8**	**102·5**	**106·6**	**105·8**	—	—	—	—
11. Calved 1886, dau. of 5 -	**101·5**	**103·7**	**105·6**	**103·4**	**101·9**	**105·8**	**104·6**	**104·1**	**101·9**	**106·3**	**106·4**	**103·0**
12. Calved 1893, dau. of 11	102·8	102·7	101·6	101·6	102·8	101·5	101·7	101·2	—	—	—	—
42. Calved 1895, son of 11	—	—	—	—	103·1	103·2	103·3	102·7	—	—	—	—
118. Calved 1896, dau. of 11	—	—	—	—	—	—	—	—	102·5	102·0	101·8	101·8
41. Calved 1892, son of 5 -	101·8	101·6	101·2	100·8	—	—	—	—	—	—	—	—
63. Calved 1894, dau. of 5 -	—	—	—	—	102·6	103·2	102·5	101·9	102·7	101·9	101·4	101·9
47. Calved 1895, son of 5 -	—	—	—	—	103·1	103·1	102·5	102·0	—	—	—	—

6. Calved 1890 - - -	**102·4**	**106·0**	**105·3**	**105·1**	—	—	—	—	—	—	—	—
83. Calved 1895, dau. of 6 -	—	—	—	—	102·3	101·4	101·7	101·6	101·6	101·5	101·5	101·4
7. Calved 1892 - - -	**101·6**	**105·5**	**104·2**	**103·3**	—	—	—	—	—	—	—	—
50. Calved 1895, son of 7 -	—	—	—	—	102·3	102·3	101·6	101·7	—	—	—	—
8. Calved 1888 - - -	**101·6**	**105·7**	**104·0**	**103·3**	**102·0**	**105·7**	**104·4**	**103·5**	**102·3**	**106·0**	**106·0**	**104·2**
44. Calved 1895, son of 8 -	—	—	—	—	102·8	102·7	102·3	102·3	—	—	—	—
109. Calved 1896, son of 8 -	—	—	—	—	—	—	—	—	102·4	102·2	101·8	101·7
9. Calved 1892 - - -	102·1	101·6	101·5	102·3	101·2	101·5	101·7	101·6	102·5	101·0	101·3	101·4
77. Calved 1895, dau. of 9 -	—	—	—	—	102·0	101·1	101·0	100·8	101·0	101·0	100·7	100·4
105. Calved 1896, son of 9 -	—	—	—	—	—	—	—	—	103·4	102·4	102·0	102·5
10. Calved 1887 - - -	**101·5**	**102·9**	**104·8**	**103·0**	**102·0**	**100·9**	**105·6**	**104·7**	**102·2**	**103·3**	**106·0**	**105·2**
84. Calved 1895, dau. of 10 -	—	—	—	—	102·5	101·7	101·6	101·7	101·6	101·5	101·6	101·4
123. Calved 1896, dau. of 10 -	—	—	—	—	—	—	—	—	102·3	102·2	101·9	101·9
13. Calved 1891 - - -	**102·4**	**106·1**	**105·9**	**104·8**	—	—	—	—	—	—	—	—
49. Calved 1895, son of 13 -	—	—	—	—	102·2	102·7	102·5	102·2	101·9	101·2	101·0	100·8
14. Calved 1890 - - -	101·2	100·6	102·2	100·9	101·2	101·3	101·8	101·7	102·6	103·4	103·0	102·1
78 Calved 1895, dau. of 14 -	—	—	—	—	102·9	101·5	101·2	101·7	101·3	102·0	101·0	100·9
117. Calved 1896, dau. of 14 -	—	—	—	—	—	—	—	—	102·1	101·6	101·7	101·5
15. Calved 1881 - - -	**101·0**	**101·0**	**105·1**	**104·0**	**102·3**	**102·7**	**105·9**	**105·8**	**[100·9**	**101·5**	**102·7**	**102·6]**
4. Calved 1892, dau. of 15 -	101·3	100·7	101·1	100·7	102·2	102·3	101·6	101·8	101·2	101·7	101·2	101·3
91. Calved 1895, son of 4 -	—	—	—	—	102·2	102·3	102·5	101·9	—	—	—	—
115. Calved 1896, dau. of 4	—	—	—	—	—	—	—	—	102·7	102·7	101·9	102·1
43. Calved 1895, son of 15 -	—	—	—	—	102·1	102·9	102·4	101·8	—	—	—	—
116. Calved 1896, dau. of 15	—	—	—	—	—	—	—	—	101·8	101·1	101·6	101·7

RESULT OF THE TUBERCULIN TEST ON THE CASTLE CRAIG HERD (*continued*).

	TEMPERATURES, MARCH, 1895.				TEMPERATURES, JANUARY, 1896.				TEMPERATURES, NOVEMBER, 1896.			
	At inoculation.	10½ hours after.	16½ hours after.	19½ hours after.	At inoculation.	9 hours after.	15 hours after.	18 hours after.	At inoculation.	9 hours after.	15 hours after.	18 hours after.
16. Calved 1890 - - -	101·6	101·0	101·6	100·8	102·2	101·8	101·5	102·2	102·5	101·7	101·7	101·4
71. Calved 1894, dau. of 16 -	—	—	—	—	102·7	101·3	101·8	101·9	—	—	—	—
89. Calved 1895, dau. of 16 -	—	—	—	—	102·0	101·4	101·7	101·6	101·6	101·7	101·3	100·9
101. Calved 1896, son of 16 -	—	—	—	—	—	—	—	—	102·2	102·7	102·0	101·6
17. Calved 1892 - - -	**101·9**	**105·1**	**104·6**	**103·1**	—	—	—	—	—	—	—	—
18. Calved 1891 - - -	102·6	101·6	101·7	101·3	102·3	101·8	101·9	101·6	102·7	102·0	101·8	102·0
54. Calved 1895, son of 18 -	—	—	—	—	102·5	103·4	102·6	102·3	—	—	—	—
104. Calved 1896, son of 18 -	—	—	—	—	—	—	—	—	103·0	102·7	102·0	102·0
19. Calved 1891 - - -	103·1	102·3	102·0	101·9	102·2	102·5	102·0	102·0	101·3	101·3	101·2	101·6
90. Calved 1895, son of 19 -	—	—	—	—	102·4	102·5	102·1	101·7	—	—	—	—
112. Calved 1896, dau. of 19 -	—	—	—	—	—	—	—	—	102·0	101·9	102·2	101·8
20. Calved 1893 - - -	**[102 8**	**104·3**	**103·2**	**102·1]**	**[102 0**	**101·5**	**102·9**	**103·8]**	**102·6**	**102·3**	**107·0**	**106·2**
114. Calved 1896, dau. of 20 -	—	—	—	—	—	—	—	—	101·9	102·2	101·6	101·3
21. Calved 1893 - - -	102·2	101·4	101·3	101·0	**101·7**	**105·5**	**105·5**	**106·3**	**102 7**	**104·3**	**106·4**	**105·0**
122. Calved 1896, dau. of 21 -	—	—	—	—	—	—	—	—	102·6	102·1	101·8	101·5
22. Calved 1893 - - -	102·5	102·0	101·6	101·1	102·1	101·7	101·3	101·2	102·5	102·3	101·6	101·5
24. Calved 1893 - - -	**102·2**	**105·6**	**104·6**	**103·0**	—	—	—	—	—	—	—	—

25. Calved 1893 - - -	102·4	101·3	101·0	101·2	101·6	100·9	101·7	101·2	101·6	101·9	101·2	101·3
26. Calved 1893 - - -	**103·0**	**104·0**	**104·7**	**103·7**	—	—	—	—	—	—	—	—
27. Calved 1893 - - -	102·4	101·7	101·6	101·4	102·2	102·1	101·6	101·1	101·9	100·9	100·8	101·1
124. Calved 1896, dau. of 27 -	—	—	—	—	—	—	—	—	102·6	102·7	102·4	102·2
28. Calved 1891 - - -	101·7	101·4	101·6	101·6	103·3	103·2	102·3	102·7	102·5	101·9	101·3	109·0
94. Calved 1895, son of 28 -	—	—	—	—	102·5	102·2	101·9	101·7	—	—	—	—
113. Calved 1896, dau. of 28 -	—	—	—	—	—	—	—	—	102·3	102·1	101·4	101·9
29. Calved 1885 - - -	100·6	100·4	101·2	101·2	**103·0**	**103·9**	**106·0**	**103·6**	—	—	—	—
30. Calved 1891, dau. of 29 -	101·6	101·1	102·2	101·5	103·2	101·4	101·6	102·0	102·2	100·7	101·4	100·8
76. Calved 1895, dau. of 30	—	—	—	—	102·4	101·9	101·1	101·3	—	—	—	—
102. Calved 1896, son of 30	—	—	—	—	—	—	—	—	102·9	102·9	101·7	102·8
75. Calved 1895, dau. of 29 -	—	—	—	—	102·5	101·5	101·3	100·9	—	—	—	—
120. Calved 1896, dau. of 29 -	—	—	—	—	—	—	—	—	101·9	101·5	102·3	101·6
31. Calved 1891 - - -	101·6	101·6	102·0	101·8	102·6	102·8	101·8	102·5	101·0	101·3	100·8	101·7
60. Calved 1894, dau. of 31 -	—	—	—	—	102·0	101·9	101·4	101·2	—	—	—	—
93. Calved 1895, son of 31 -	—	—	—	—	102·5	103·2	102·6	102·2	—	—	—	—
119. Calved 1896, dau. of 31 -	—	—	—	—	—	—	—	—	102·1	102·5	101·0	101·2
32. Calved 1890 - - -	101·2	102·1	101·7	101·8	102·5	102·6	102·3	101·9	102·0	101·4	101·7	101·4
58. Calved 1893, dau. of 32 -	—	—	—	—	102·2	102·1	102·1	101·7	101·6	101·7	101·9	102·2
61. Calved 1894, dau. of 32 -	—	—	—	—	101·9	101·5	101·2	100·5	—	—	—	—
95. Calved 1895, son of 32 -	—	—	—	—	102·5	102·4	102·2	102·1	—	—	—	—
110. Calved 1896, son of 32 -	—	—	—	—	—	—	—	—	102·1	102·4	101·3	101·6
33. Calved 1891 - - -	102·8	102·4	102·4	102·4	102·6	101·7	101·5	102·5	102·0	101·4	101·4	101·0
67. Calved 1894, dau. of 33 -	—	—	—	—	102·7	101·3	101·3	101·5	102·3	101·6	101·4	101·4
96. Calved 1895, son of 33 -	—	—	—	—	102·6	103·1	102·8	102·3	—	—	—	—
99. Calved 1896, son of 33 -	—	—	—	—	—	—	—	—	102·7	103·0	102·6	103·7

is in charge of that branch of the work of the Department.

'I may say, however, that at the opening of the importing season last spring Dr. Salmon, chief of the United States Bureau of Animal Industry, notified me that he had instructed Dr. Geddes, his officer in Britain, to refrain from further testing in herds where 20 per cent. or more of animals tested had reacted. In accordance with the policy of mutual action agreed on between the two countries, I at once issued similar instructions to Dr. Hopkins. Lists of herds coming under this restriction were exchanged by these two officers from time to time during the summer, with the result that a considerable number of British breeders are now debarred from having animals tested for shipment either to the United States or to Canada.

'In the early part of October it became necessary for Dr. Hopkins, after asking for and receiving instructions by cable, to announce to Canadian importers that cattle purchased from certain herds would be subjected to a further tuberculin test in quarantine, after arrival in Canada.

'These new departures gave rise to considerable newspaper discussion in Britain, the result of which will, I think, eventually prove of great benefit both to breeders and importers.

'Recent investigations have demonstrated that a considerable period—viz., from eight to fifty days—elapses between the date of infection with tuberculosis and the time when it is possible to obtain a reaction to the tuberculin test.

'This fact, taken in conjunction with our experience, in 1901 and 1902, of the doubtful methods used to evade the test by some British breeders, led me last winter to recommend to you the discontinuance of the official testing in Europe of cattle intended for export to Canada, and the adoption instead of the plan of testing such animals after their arrival in the Canadian quarantine. With your approval, therefore, and I may add with that of the executive committee of the Dominion Cattle Breeders' Association, all cattle now imported to Canada from Europe are tested after they have been sufficiently long in quarantine to settle down and become accustomed to their surroundings. The test is made under such conditions as ensure fair play to the animals and their owners, as well as to the officer entrusted with the work. Animals which react, but do not show clinical symptoms, are permanently ear-marked and listed, and may then be removed at the expiry of the usual period of quarantine without further restrictions, save that they must at no time be offered for export to the United States, so long as the regulations at present maintained by that country continue in force.

'Canadian cattle reacting to tuberculin when tested for export, or otherwise, are treated in a similar manner. Some difficulty was experienced in obtaining a satisfactory permanent ear-mark, and it was only after considerable experimentation that the present instrument was evolved. The mark finally decided on is a large 'T,' cut clean out of the right ear; a small notch in the margin of the same ear is also added to denote the year in which the test is made.

'While this method of dealing with reacting cattle may evoke some criticism, I am satisfied that under existing conditions of knowledge and sentiment *re* bovine tuberculosis, it is the most sensible solution of the problem which confronts those charged with the task of controlling the disease.'

In the Argentine I made numerous inquiries as to the reliability of the test out there, and I obtained the following data from the Ministry of Agriculture:

Years.	Total Cattle imported.	Cattle reacting to Tuberculin.	Slaughtered.	Reshipped to Foreign Countries.
1898 -	500	47	1	46
1899 -	741	60	2	58
1900 -	449	32	13	19
1901 -	37	1	1	—
1902 -	74	7	6	1
1903 -	791	94	79	15
1904 -	1,191	171	153	18
Total -	3,783	412	255	157

This table shows that during the last seven years 255 bulls have been slaughtered, and of these, probably for all practical breeding purposes, 250 would have made better sires for English herds than the 250 used in place of them. The loss on the seven years averaged about 11 per cent. Of the 412 animals reacting, 353 were accompanied by a veterinary surgeon's certificate testifying them to be 'free from tuberculosis.' Of the 255 slaughtered, 254 are reported on post-mortem examination to show evidence of tuberculosis.

I further asked: 'Is the tuberculin test considered reliable as a diagnostic agent from the experience obtained in the Argentine?' Answer: 'Based on the experience obtained from the tests made on imported animals, on 52,716 dairy cows, and on 21,873 other cattle tested at different *estancias* by official veterinary surgeons, it is considered absolutely reliable.'

The commercial value of the tuberculin test is very great. Valuable animals are prohibited from movement, or slaughtered according to its diagnosis, and hundreds of thousands of pounds are involved in its annual use.

The other aspect of the case has now to be considered. Let us take insurance. I can insure a cow or bull from my farm to an Argentine *estancia*, at Lloyd's, at the rate of £3 per cent. without the tuberculin test. If I wish to insure that the animal shall pass the test at Buenos Ayres, I must first get a certificate saying it has done so here, and then pay an insurance of £26 6s. per cent., with a rebate of £5 if no claim is made. This means that the most experienced body of insurers in the world regard the risk of an animal which has passed the tuberculin test in England not passing the test in Buenos Ayres in two months' time as from 15 to 20 per cent. This rate has been made as the result of somewhat costly experience. Some time ago the rate was 15 per cent. The rate of insurance suggests on the face of it that the commercial value of the tuberculin test is small. I took an opportunity of placing the position before the Argentine Board of Agriculture, and asked how they accounted for the discrepancy, and whether they could suggest a means by which animals could be tested satisfactorily before leaving England. The reply was:

'That the experience acquired in Argentina respecting the tuberculin test has absolutely confirmed the conclusions established by Nocard, and the discrepancy in the results of the test of the same animal tested in England, and a few weeks later in Buenos Ayres, can only be attributed to either of the following causes:

'(*a*) Animals having been prepared before being tested.

'(*b*) Incorrectly tested.

'(*c*) Incorrectly certified.'

Granted that no veterinary surgeon can tell if the animals he has to test have been already prepared by inoculation—if this has been done it renders them insensitive to a second inoculation—and that it has been experimentally proved that 12 per cent. of those tested will not react if reinoculated before thirty days have elapsed since the first inoculation took place, 4 per cent. if before forty days, and 2 per cent. if before fifty days, I am convinced that there are only two ways by which this can be attained: (1) That all animals before being tested should be kept under close observation directly under the control of the Board of Agriculture for fifty days. (2) That all animals intended to be exported should only be tested by official veterinary surgeons appointed by the Board of Agriculture, who should only use a specially prepared tuberculin which could not be obtained by a private individual.

In going through some twenty temperature charts of animals which had been certified as having passed the tuberculin test in England, and which had reacted in the Argentine, I noticed that several of the animals had been taken out on one particular ship, and I think it would be of interest, and perhaps profit, if we could get a record of the ships which have carried cattle to Argentina the last three years, and compare the post-mortem reports, noticing in how many cases the tuberculosis was of recent origin, and in how many cases it was of old standing.

This information would be of value on the question as to whether the tuberculin ever causes tuberculosis, or whether it excites the disease to activity, both of which statements are made by agriculturists, and are even suggested in some cases where there is a discrepancy in the tests. If our Board of Agriculture had some years ago made a regulation that the results of all testings, and the place where the tuberculin was obtained from should be filed with them, there would now be some most useful statistics on which to take beneficial action.

CHAPTER V

THE USE OF TUBERCULIN IN THE DETECTION AND PREVENTION OF DISEASE

The means which a farmer can adopt under present conditions will go far to lessen and check the disease; but his efforts are largely counteracted because there is no restriction placed on the keeping and sale of clinically-affected animals, and the authorities do not help him either with tuberculin or expert advice, as they can and should do.

Although there is a danger in all businesses of too much officialism and over-inspection, very much can be done by the State without any great increase in inspection by inducing farmers to work on voluntary lines in a practical manner which will not interfere with their business.

It is to the interest of all farmers who sell milk to provide a good, pure article which the public can take in quantity in confidence, without sterilization or boiling. By producing pure milk it will help to keep milk at a better price, and to keep the milk trade in our own country.

In getting rid of the disease, a farmer must be prepared to give the subject a little thought and attention, and be ready to rearrange his herd, and in some cases to alter his cowsheds. This course, it is certain, will amply repay him by the general improvement in the health and hardihood of the animals, and will prove of lasting benefit.

The first thing to do is to test the herds of cattle.

Experience in testing a number of herds has shown that it is only necessary to test breeding animals; consequently the matter resolves itself into testing cows, heifers, and bulls. Cattle must have been at least a week in their homes, under normal conditions, before the test can be properly applied. Cattle that have been driven long distances, or have come by boat or rail, cannot be tested until the effect of the journey has passed off. Should this be done prematurely, the results obtained are unreliable. While being tested, the cattle must be kept tied up in their regular stalls for a period of eighteen hours, and fed on their usual food.

The results will not be satisfactory if the cattle are taken in from the fields, or even from a strawyard, and tested the same day. They must be kept tied up at least twenty-four hours before they are tested, and great care is necessary to see that their temperatures are normal. Cattle out at grass during the day and housed at night may be tested by keeping them in for a day. Even in this case it will be found that the excitement consequent on their not being allowed to go out as usual may increase the temperature of one or two of the cows to the extent of a degree or more.

The cattle should be injected either last thing at night or early in the morning, so that the temperatures can be taken during the daytime.

The following directions are issued from the Research Laboratory, Royal Veterinary College, London, by Professor MacFadyean, for using tuberculin:

Directions for using Tuberculin

'1. While under the tuberculin test, cattle ought to be kept in the house, fed on their usual food, and protected from draughts.

‘2. The dose of tuberculin for a medium-sized cow is 3 c.c., or 50 minims, and it may be varied a little above or below that, according to the size of the animal.

‘3. It ought to be injected under the skin with a clean hypodermic syringe. The most convenient points are in front of the shoulder, or on the chest-wall behind the point of the elbow. The best form of syringe is one with an asbestos piston, as the whole instrument may be sterilized by boiling it in water for five minutes before use.

‘4. The tuberculin must be injected into the subcutaneous connective tissue, and care must be taken that the whole dose is introduced.

‘5. The temperature must be taken at the time of injection, and at the ninth, twelfth, fifteenth, and eighteenth hours afterwards. When there is any reason to suppose that the animal may have been already tested with tuberculin during the preceding two or three weeks, it is advisable to take the temperature at the third and sixth hours, as well as at the times just mentioned.

‘6. Animals in which the temperature, during the eighteen hours following the injection, rises gradually to 104° F., or more, may be classed as tuberculous, and those in which it remains under 103° F. as not tuberculous. When the maximum temperature attained is under 104° F., but over 103° F., the case must be considered doubtful, and the animal may be retested after a month.

‘7. The test is not reliable in the case of animals in the last stage of the disease, or in those in which the temperature is over 103° F. before injection.

‘8. The tuberculin should be kept in a cool place, and protected from light. Should it become turbid or cloudy, it must not be used.

‘9. The tuberculin test does not render the milk in any way injurious.’

In herds containing many suspected animals which have been tested for the first time, it is often observed that the diseased animals are, or have been, in groups in contact with each other.

Table showing Rise of Temperature in Cows Affected with Tuberculosis, and showing how Diseased Cows are Grouped Together.

No.	February 3, 1897.		February 4, 1897.				
	11 a.m.	Injected 10 p.m.	6 a.m.	9 a.m.	12 a.m.	3 p.m.	
1	—	102·0	101·0	101·2	101·2	101·4	—
2	101·8	101·0	101·3	101·5	102·2	103·6	Doubtful.
3	102·0	101·0	101·2	100·8	101·0	101·3	—
4	101·1	101·2	101·5	102·4	104·3	103·7	Reacted.
5	101·6	103·0	102·5	104·5	106·0	105·0	,,
6	102·0	101·8	101·3	102·0	104·3	105·4	,,
7	101·1	101·6	101·4	101·0	101·4	101·7	—
8	101·2	101·4	100·8	101·0	101·3	101·4	—
9	102·1	102·5	103·3	106·5	107·6	105·3	Reacted.
10	102·0	102·0	102·2	104·1	105·4	105·5	,,
11	100·6	101·6	104·0	106·3	105·9	105·8	,,
12	102·2	101·0	101·6	102·4	105·9	106·0	,,
13	101·5	100·8	104·6	105·0	104·1	103·4	,,
14	102·5	102·2	102·4	103·9	106·3	105·7	,,
15	103·8	103·0	103·4	105·9	105·5	106·0	,,
16	101·8	102·0	102·2	102·8	105·2	106·0	,,
17	101·3	101·8	101·4	102·2	105·5	105·7	,,
18	102·0	102·3	104·6	104·0	103·3	103·5	,,
19	101·3	101·4	100·6	100·0	101·1	101·2	—
20	102·0	101·9	102·0	101·5	101·9	102·5	—
21	102·0	102·7	102·7	103·5	101·9	103·4	—
22	102·8	102·1	105·0	107·5	106·7	104·8	Reacted.
23	102·4	102·2	103·4	105·5	106·4	104·5	,,
24	101·4	101·8	101·3	102·6	106·1	105·2	,,
25	102·0	101·8	102·6	106·0	107·4	105·4	,,
26	102·1	101·4	102·8	105·6	106·3	104·1	,,
27	101·8	101·6	101·8	101·4	101·5	101·6	—
28	101·5	100·5	101·4	102·9	106·0	105·3	Reacted.
29	101·8	101·0	101·2	101·5	101·0	101·6	—
30	101·5	101·6	101·0	101·5	101·7	101·0	—
31	100·8	101·1	101·0	101·2	101·3	101·2	—
32	102·3	102·0	101·7	100·8	102·1	101·5	—
33	102·4	101·1	101·0	101·3	101·4	101·3	—
34	102·0	101·8	101·6	102·6	106·1	104·4	—

After having found out those animals which are affected, it becomes necessary to separate them from the sound animals. If there are two cowhouses on the farm, or the owner has two farms, the cattle can be easily divided and kept apart. Where there is only one shed it is more difficult, but the two lots of cows should be put at separate ends, and a cheap boarded or canvas partition erected to separate them, which should be thoroughly lime-washed and cleansed every six months.

Many cows that have reacted will be found to be only slightly affected, and if they have been kept in a hot, close, badly-ventilated stall, there is no doubt that by a change to an open-air life, particularly in bracing hilly districts, a number will recover. This is seen by a reference to the following table:

TABLE SHOWING THE POSSIBILITY OF RECOVERY WHERE SLIGHT CASES ARE PLACED UNDER FAVOURABLE CONDITIONS.

No.	1897.						1898.				
	FEB. 3.		FEBRUARY 4.				MAR. 1.	MAR. 2.	MARCH 3.		
	11 a.m.	10 p.m.	6 a.m.	9 a.m.	12 noon.	3 p.m.	10.30 a.m.	8 p.m.	5.30 a.m.	10 a.m.	2 p.m.
II.	101·8	101·0	101·3	101·5	102·2	103·6	101·4	101·2	101·0	101·2	101·8
VIII.	101·8	101·4	100·8	101·0	101·3	101·4	101·4	101·2	101·0	101·6	101·2
IX.	102·1	102·5	103·3	106·5	107·6	105·3	101·2	101·2	102·0	103·6	104·6
X.	102·0	102·0	102·2	104·1	105·4	105·5	101·2	101·4	101·4	101·6	102·2
XIII.	101·5	100·8	104·6	105·0	104·1	103·4	101·4	101·2	100·6	101·4	101·6
XVI.	101·8	102·0	102·2	102·8	105·2	106·0	101·4	101·0	101·2	101·6	101·8
XVII.	101·3	101·8	101·4	102·2	105·5	105·7	101·4	101·2	101·0	101·6	101·2
XIX.	101·3	101·4	100·6	100·0	101·1	101·2	101·4	101·2	101·0	101·6	101·2
XXV.	102·0	101·8	102·6	106·0	107·4	105·4	101·0	100·6	101·0	102·0	101·8
XXVIII.	101·5	100·5	101·4	102·9	106·0	105·3	102·2	101·2	101·4	101·2	101·4
XXXIII.	102·4	101·1	101·0	101·3	101·4	101·3	101·2	101·2	102·0	103·6	102·2
XXXIV.	102·0	101·8	101·6	102·6	106·1	104·4	101·2	101·2	101·0	101·2	101·4

In 1896 these cows had been tested and found free from disease; they were then placed in the same stall with others that were affected, and the shed in which they were kept had contained tuberculous cows for some years.

The shed is a good one, airy, well built, and with means of ventilation. During the winter the temperature rarely, if ever, exceeded 50° F. During the autumn after the 1897 testing the cows were kept in the same shed, but, owing to the prejudice of a cowman, the windows and ventilators were rarely opened, and the temperature of the shed was continually at 60° F. and over. It was hot and close, and after the shed was shut up the air quickly became so foul that it was most unpleasant to enter it. In the spring of 1898 this condition of things was changed. The cows were turned out on some hill-pastures, where the air is particularly bracing, and when they came into the sheds at night, windows and ventilators were kept open. As the result of this, during the past winter the shed has always been perfectly sweet and clean.

The very different results obtained in 1897 and 1898 go far to show that recently-affected cows may recover. They also emphasize once again the most important fact that large air space and ventilation are requisite, not only for the well-being of men, but also for all animals.

Cattle that react should, therefore, be given every chance of recovery; but it is wise to get such animals fat as soon as possible, and killed, as the disease may not be arrested, and they are under certain conditions a constant menace to the health of other animals. Tuberculosis rarely spreads from one animal to another when they are at pasture, because cows do not, as a rule, eat over the same particular piece of ground as another cow does during the same day, and the sunlight has such a powerful germicidal action that the tubercle bacilli are soon killed. If it is practicable, it is wisest to keep the cattle in separate fields.

The great majority of cowsheds are much smaller than they should be, and though this defect is being gradually remedied, still the condition of very many leaves much to be desired. In the course of a number of observations I made during February, 1898, I found that the inside temperature depended very greatly on whether the owner took advantage of the means of ventilation or not. Those sheds that had the greatest air space were the least draughty and sweetest.

No.	Number of Cows.	Breed.	Cubic Feet Air Space.	Outside Temperature.	Inside Temperature.	Condition of Shed.
I.	25	Jersey	500	33° F.	42° F.	Very sweet.
II.	28	,,	421	39° F.	45° F.	,,
III.	24	Short-horn	600	33° F.	52° F.	Fairly sweet.
IV.	24	,,	520	33° F.	52° F.	,,
V.	9	,,	414	33° F.	52° F.	,,
VI.	28	,,	450	33° F.	60° F.	Very close and foul.
VII.	25	,,	888	40°-45° F.	40°-45° F.	Very sweet.
VIII.	20	,,	888	38°-58° F.	38°-58° F.	,,
IX.	36	Jersey	544	30° F.	60° F.	Unstated.

We know that for the production of milk warmth is beneficial, but where the warmth is obtained by keeping the animal in foul air, more harm than good is done, and no cowshed, even at midnight, should smell hot and unpleasant. When tuberculosis exists in a shed, the stall should be kept scrupulously clean, and scrubbed down weekly with an ounce of carbolic acid in every pailful of hot water used.

The prevention of tuberculosis can be aided largely by the State.

In future all new buildings should be larger, more airy, and better paved and drained than is the case in the existing ones. Sufficient light should be insisted upon, so as to obviate dark corners. In summer the windows can have sacks hung over them, if necessary. The ventilation should be so ample that when the stalls are full of cows the air inside the shed should be as sweet to breathe as it is outside.

Tuberculin should be supplied direct from the Government, and no other kind should be used. It should be supplied only to the County Veterinary Inspector, and he should be empowered to supply it to veterinary surgeons free of charge, a return on a schedule being made to him of the place and time it was used and the results obtained.

All cattle tested should have a tag or brand put on the ear. Where a herd has been tested, the Inspector should see that the animals are kept apart, and if a cow's milk is being used, particular care should be exercised as to the condition of the udder. To sell milk from a cow with a diseased udder, or to drive an animal along a highway when it shows symptoms of the disease, should be made a penal offence.

The Royal Commission on Tuberculosis (1896), in their Report, recommend that notification of every disease in the udder should be made compulsory on all owners of cows; that local authorities should have power to exclude from their districts the milk of cows thus affected, or which show clinical symptoms of the disease; that powers be given to local authorities to take samples and make analyses of the milk produced or sold in their districts (including that coming from foreign countries), and that milk-vendors should be required to supply sufficient information as to the sources from which their milk is derived.

As regards cowsheds in urban districts, the recommendations are, that in future no cowshed shall be permitted within 100 feet of any dwelling-house; and that the discontinuance of any one already existing shall be ordered on the certificate either of the Medical Officer of Health that it is injurious to the health of human beings residing near it, or of the veterinary inspector that it is not a place wherein cows ought to be kept for the purpose of milk-supply, and that it is incapable of being made so.

The conditions they recommend for new cowsheds are:

1. An impervious floor.
2. A sufficient water-supply for flushing.
3. Proper drainage.
4. A depot for the manure at a sufficient distance from the byres.
5. A minimum cubic contents of from 600 to 800 feet for each adult beast, varying according to the average weight of the animal.
6. A minimum floor-space of 50 feet for each adult beast.
7. Sufficient light and ventilation.

The Commissioners think that the above conditions should also hold in the case of cowsheds in rural districts, except in so far as cubic contents per cow are concerned. As regards these cubic contents, such space per cow should be provided as would, in view of the surrounding circumstances, secure reasonable ventilation without draught.

For the elimination of bovine tuberculosis the recommendations are that the Board of Agriculture should manufacture tuberculin and offer it gratuitously, together with the services of a veterinary surgeon, to stock-owners, on condition—

1. That the test be applied by a veterinary surgeon.

2. That tuberculin be supplied only to such owners as will undertake to isolate reacting animals from healthy ones.

3. That the stock to be tested shall be kept under satisfactory sanitary conditions.

In Manchester the following regulation is in force:

'*For Prescribing and Regulating the Lighting, Ventilation, Cleansing, Drainage, and Water-supply of Dairies and Cowsheds in the Occupation of Persons following the Trade of Cowkeepers or Dairymen.*

'A person following the trade of a cowkeeper or dairyman shall observe the following regulations with respect to every cowshed in his occupation—viz.:

'1. He shall provide for the effectual lighting thereof in all parts.

'2. He shall cause every cowshed in his occupation to be provided with adequate means of ventilation, and to be properly ventilated at all times when such cowshed is in use.

'3. He shall cause every cowshed in his occupation to be maintained at all times in a thorough state of cleanliness, and so that no offensive matter is allowed to sink into the floor.

'4. He shall cause every cowshed in his occupation to be effectually drained, and in such a manner as not to allow of direct communication by means of any drain between the interior of such cowshed and any sewer or cesspool into which such drain may enter.

'5. He shall cause the cowshed to contain for each animal proposed to be kept therein a space of at least 600 cubic feet, any portion at a height exceeding 14 feet not being taken into account in reckoning such space.

‘6. He shall provide an adequate supply of wholesome water, either constant or stored in a metal or slate cistern, which he shall provide with a proper cover and maintain in a thoroughly clean condition.

‘7. He shall cause the floor to be thoroughly cleansed twice a day at appropriate times, and shall at the same time remove all dung from the cowshed.

‘8. He shall cause every cowshed in his occupation to be thoroughly cleansed from time to time, as often as may be necessary to keep the same in a clean and wholesome condition.

‘9. Where any part of the inner surface of the walls of the cowshed is covered with hard, impervious material, he shall cause such part to be so cleansed at least once in each week.

‘10. He shall cause the roof and the walls, except so much thereof as may be painted or covered with materials such as to render lime-washing unsuitable, and as may be properly cleansed, to be lime-washed at least twice in each year—viz., in the months of March and October—and at such other times as may be necessary.’

In Denmark much has already been done by separation and isolation of the diseased animals, and a reference to the legislation of foreign countries may indicate what is likely to be done here.

Many countries have, through the Veterinary Department of the Government, issued instructions on the employment of tuberculin as a diagnostic agent for the use of farmers and stock-owners generally, and one or two have passed laws with regard to its employment.

Although it was first employed on an extensive scale by Professor Bang in Denmark, the conditions under which it was tried there were voluntary, and Belgium may be said to have been the first country to take legal steps with regard to its employment, in 1895.

It is interesting to note that the Belgian Government was led to legislate on the subject by the knowledge gained as to the extent of the disease in the country by the thorough system of meat inspection instituted in 1890. As regards this first measure, which was admittedly an experiment, it was found to be too drastic, as the test was made almost compulsory on all cattle in consequence of the fact that, if tuberculosis was found post-mortem in an animal, none of the animals which had occupied the same shed were allowed to be sold, except for the meat market, unless they failed to react to the test.

The first law, therefore, was replaced by a less stringent one, which was passed in August, 1897.

By this regulation the use of tuberculin is only permitted under a special authorization of the Minister of Agriculture, in order to prevent frauds which might easily be committed were anyone to be allowed to use it. The tuberculin is supplied gratuitously to the veterinary surgeons, and those animals only which show symptoms of tuberculosis are tested. If they react, they must be slaughtered within a week. In cases where tuberculosis is found in animals slaughtered for the meat market, the owner is required to notify within five days the place from which the animal came, and a veterinary inspection may be made of all the animals in the herd, except such as are being fattened, for the purpose of dealing with any that show suspicious symptoms. Any stock-owner may have his herd tested on condition that he does not sell, except for the meat market, the reacting animals, and that he isolates those that fail to react from those that do. The farmer can, however, continue to make use of the reacting animals so long as they show no clinical signs of the disease, provided he removes the calves from their mothers soon after birth, and submits all newly purchased animals to the test before allowing them to mix with the other animals.

Provision is made for testing when necessary any animal that is imported into Belgium from any neighbouring country.

Compensation is given in certain cases, a distinction being drawn between the animals found tuberculous after slaughter in the ordinary course for the meat market, and those slaughtered by order of the authorities as being clinically affected. In the first case, 50 per cent. of the value of the flesh and organs is given when the carcase is totally condemned, and in the second, when it is a question of breeding cattle, 70 per cent. of the value of the animals estimated as perfectly healthy if the flesh is totally condemned as unfit for food. But in no case can the compensation exceed £17. When the flesh of the animal can be sold as fit for food, 25 per cent. of the same value is given. When it is not a question of breeding cattle, the conditions are very similar to those prevailing for animals intended for the meat market.

The compensation is safeguarded by requiring: (1) A veterinary surgeon's certificate, stating whether the flesh was or was not fit for food; (2) a statement from the local authority as to what was done with the flesh; and (3) proof that the animal had been in the country for six months.

In France a decree was passed in March, 1896, requiring that all cattle, except such as are intended for the meat market, imported into the country should be submitted to the tuberculin test, and placed under observation on the frontier for forty-eight hours.

Reacting animals are to be sent back to the country from which they came, after having been marked, unless the importer consents to their immediate slaughter.

An Act was passed by the French Government in October, 1904, of a far more stringent nature, and I am giving a translation of it because it shows very plainly the trend of official action in attempting to control tuberculosis.

ORDER OF OCTOBER 6, 1904.

Tuberculosis in Cattle.

Animals which present clinical symptoms of tuberculosis are to be slaughtered upon an order of the Mayor, after due notice from an official veterinarian. Slaughter shall take place either in a public slaughter-house, inspected by a veterinarian, or on the spot (farm).

In this last case the Veterinary Officer of Health watches the operation and makes a post-mortem, the certificate of which is made in duplicate; one copy is delivered to the Mayor who has delivered the order for slaughter, the second is handed to the Prefect.

ARTICLE 43.—When the existence of tuberculosis is found, the Prefect issues an order declaring as infected places all yards, enclosures, meadows, and pastures occupied by the diseased animals.

ARTICLE 44.—The measures provided by Clause I. of Article 33 of the law of June 21, 1898, are applicable in the case of tuberculosis.

ARTICLE 45.—It is also forbidden to sell animals presumed to be infected for any other destination than the butcher, except what shall be allowed according to Article 46, following. In the case of sale to the butcher, slaughtering is to take place on the same spot as is provided by Article 42, or in a public slaughter-house inspected by a veterinarian. In the case of transport to a slaughter-house the animals are branded and a pass signed by the Mayor is given by the Veterinary Officer of Health, the pass being sent back to the Mayor in five days from its date, with a certificate from the Veterinary Inspector of the slaughter-house, certifying that the animals have been slaughtered, and stating the results of the post-mortem.

ARTICLE 46.—When the animals of a district declared to be infected have been submitted by the Veterinary Officer of Health to the tuberculin test, the regulations under Articles 44 and 45 are exclusively applicable to those animals in which the injection has produced a reaction revealing the existence of the disease. As soon as they show clinical symptoms of the disease they shall be killed by order of the Mayor under the conditions provided by Article 42. As for those which shall have been subjected to the tuberculin test without revealing any reaction, the owner shall be allowed to dispose of them as he will, on the condition that he separates them immediately from the others, with which they are not to have further contact, and that they shall be put in disinfected places. The calves born of cows in which the tuberculin test has revealed the existence of the disease are numbered and marked unless they are quite isolated from their mother directly after their birth, in which case they can be placed in the sheds with the healthy animals, and the owner has free disposal of them.

ARTICLE 47.—The flesh of tuberculous animals is to be seized and excluded from consumption either totally or in parts, according to the case which is determined under Government Regulations.

ARTICLE 48.—The Declaration of Infection cannot be removed by the Prefect except all the affected animals have been slaughtered, and only then after entire disinfection. It can be removed immediately after the disinfection of the stalls, yards, paddocks, and pasture-lands reserved for those animals which have undergone the tuberculin test without the disease having been revealed.

In Germany, so far as is known, there has been no definite legislation on the subject, but most of the states have made arrangements for the preparation of tuberculin in the veterinary colleges, and have circulated information to farmers and agricultural societies as to the means of applying the test, and the interpretation to be put upon the results obtained.

In Denmark nearly £6,000 is allocated in the annual Budget for the purpose of assisting owners to make use of tuberculin.

Only those cattle-owners, however, can benefit from the gift of tuberculin and the services of a veterinary surgeon free of cost who will undertake to keep the healthy animals isolated from those that react, by means of a partition erected in the shed. The work is under the superintendence of Professor Bang, one of the greatest authorities on bovine tuberculosis; and in April, 1897, there had been tested in the whole of Denmark 5,306 herds, numbering 144,800 cattle. The results are eminently satisfactory, and anyone who has had the opportunity of seeing the work carried out there cannot but be struck by the simplicity and slight cost of the arrangements necessary to bring about success.

In Switzerland and Norway action has been taken to supply tuberculin gratuitously to such stock-holders as wish for it.

In some of the United States of America very active measures have been taken to combat bovine tuberculosis by means of tuberculin. For instance, the following are the main provisions of a general Order as regards the importation of cattle into the State of Massachusetts issued by the Board of Cattle Commissioners in July, 1895.

All owners desirous of introducing neat cattle into the State must produce a certificate based on a tuberculin test, carried out by a veterinary surgeon, that such cattle are free from tuberculosis, and stating the quantity injected and the temperature resulting from such injection. On their arrival, the animals are quarantined until they have been inspected by an officer of the Board. Animals imported without a certificate of soundness will be quarantined and submitted to a tuberculin test after the lapse of six days at the owner's expense. Should they react, they are condemned and killed.

Compensation up to the full value is given for the slaughter of animals by reason of tuberculosis, provided the animal has been in the State for six months, and there has been no contributory neglect on the part of the owner.

Numerous experiments have been carried out at the agricultural colleges of the various States on the use of tuberculin, and pamphlets, in all cases recommending the use of tuberculin, have been issued.

From this very brief summary of the legislation that has been enacted by other countries, it is apparent that tuberculosis is considered a contagious disease, a dangerous disease, and a disease that can be eliminated, or at least controlled.

CHAPTER VI

MILK INSPECTION

EXPERIMENTS made for the Royal Commission (1890), and observations since published, show that the milk of a cow only contains tubercle bacilli when the udder is affected, and it has been proved (MacFadyean, Bang, Carmichael) that healthy calves can be reared by cows that have tuberculosis, but the udders of which are free from disease. The percentage of cows that have tuberculous udders is fortunately comparatively small, but the virulence of the milk is so great that animals taking it readily become infected with the disease. It has been found that not more than from 1 to 2 per cent. of tuberculous cows have the udder affected. Such cows are dangerous, and ought on no pretext whatever to be kept in a dairy.

Dr. Salmon, in his 1904 report to the United States Government, says that this view is antiquated, and quotes Mohler's investigations, when, with fifty-six reacting cows, it was found that twelve of these, or 21·4 per cent., at one time or another during the experiment, gave milk which contained virulent tubercle bacilli. Undoubtedly, cows with tuberculosis of the udder yield milk containing a larger number of tubercle bacilli than do those in which the udder remains unaffected, and are, therefore, more dangerous; but it has been clearly shown that other tuberculous cows may yield virulent milk.

The danger that children run by drinking raw milk from farms where the cows are not kept under the best conditions, with the probability that one or two have tuberculous udders, cannot be overestimated. When the milk from several cows is mixed the danger is lessened, as, if one animal is thus affected in the udder, the individual dose is diluted. The practice of keeping a particular cow for nursery-milk should only be allowed under strict veterinary supervision, and it is wisest to let children have the mixed milk, unless it is quite certain that the cow is absolutely healthy. It cannot be too strongly insisted on that milk is a variable article, produced under very different conditions, and because the price of milk is lower in one dairy than in another, it does not follow that it is in reality a cheaper article. The richness of the milk depends upon the way in which the animals are fed and looked after. The colour is no criterion of its quality, as there is very little, if any, milk sold in some large towns that is not coloured artificially before it reaches the consumer. Boiling kills the tubercle bacilli, and this simple expedient should always be resorted to, unless it is known that the cows are perfectly healthy.

It is probable that in the future there will be a great extension of the principle of the application of heat to milk prior to its sale, for the purpose of destroying the pathogenic micro-organisms which in one way or another may gain access to it. Outbreaks of typhoid fever, scarlet fever, and diphtheria have repeatedly been traced to milk-supplies, and the very high diarrhœal death-rate in children is largely due to the presence of putrefactive organisms in stale milk.

In the application of heat in addition to simple boiling or scalding, the two methods employed are pasteurization and sterilization. By pasteurized milk is meant milk that has been raised to a temperature of about 167° F. for half an hour. This temperature, at first considered sufficient to destroy the germs of tuberculosis, scarlet fever, etc., has now been proved insufficient. The taste of milk thus treated is only slightly altered, and in some cities, as, for instance, Copenhagen and Paris, there is a large demand for this pasteurized milk, which is sold in glass bottles.

Experiments show that a temperature of 167° F. is not always sufficient to destroy the virulence of the germs, and Bang's experiments show that, whether the germs were exposed to a temperature of 167° F. (pasteurization) for a period of one minute or twenty minutes, the results were the same. It appears that the lowest reliable temperature for killing the germs and spores of tuberculosis is 185° F. This is a matter of great importance, as a very considerable trade has been built up on a misconception of these figures. As long as milk is not heated to over 167° F., there is very little alteration in its flavour, and if it is rapidly cooled after being heated to that degree, few people perhaps would detect any difference in it from milk direct from the cow. But when we heat milk to 185° F., or over, there is a distinct flavour imparted to it, and a constituent of the natural milk which helps to prevent scurvy and rickets in children is altered or destroyed. It is, therefore, impossible for milk to be placed on the market as is claimed by some dairy companies, 'pasteurized, freed from all disease germs, and the taste unaltered.' The two things, killing the tubercle germs and spores, and the unaltered flavour of the milk, cannot go together.

By sterilized milk is meant milk that is raised to such a temperature that all organisms and their spores are destroyed, so that, when hermetically sealed, the milk keeps perfectly well for an indefinite time. To render milk thus sterile, it is usually placed in bottles in a steam sterilizer (an apparatus not unlike that used in steam disinfection), where the temperature can be kept at rather over 212° F. for some time.

In this country hitherto local authorities have had no powers for controlling the danger to man from the sale of milk of tuberculous cattle, even when the udder is diseased. The Dairies, Cowsheds, and Milkshops Order, 1885, prescribes and regulates the lighting, ventilation, cleansing, drainage, and water-supply of dairies and cowsheds, and states that if at any time disease exists among the cattle the milk shall not be used for human food. Unfortunately, this cannot be stretched so as to cover tuberculosis, since that disease was not included in the Contagious Diseases (Animals) Act, 1878, under which the Order was instituted. Nor has it been found possible to make use, as regards tuberculosis, of the section in the Infectious Disease Prevention Act authorizing the Medical Officer of Health to stop the sale of milk from a dairy from which he believes infectious disease is being spread. In some local Acts, however, such as those of Glasgow, Manchester, and Brighton, steps have been taken with the view of preventing the sale of tuberculous milk, and hence the Royal Commission recommends an extension of such powers in the direction of systematic inspection of the cows in dairies and cowsheds by the officers of the local sanitary authorities within whose districts the premises are situated; inspection, when desired, of the cows in any dairy or cowshed, wherever situated, by the authorized officers of local authorities within whose districts milk from the premises in question is supplied; power for a Medical Officer of Health to suspend the supply of milk from any suspected cow for a limited period pending veterinary inspection; power to prohibit the sale of milk from any cow certified by a veterinary surgeon to be suffering from such disease of the udder as in his opinion renders the animal unfit for the supply of milk, or exhibiting clinical symptoms of tuberculosis; and the provision of a penalty for supplying milk for sale from any cow having obvious udder disease without the possession by the owner of a certificate to the effect that such disease is not tubercular. They further recommend that notification of every disease in the udder shall be made compulsory, under penalty, on the owners of all cows, whether in private dairies or those in which the milk is offered for sale. The reason it is advisable that all diseases of the udder should be notified is that notification of tubercular disease of that organ alone would fail of the object in view, as expert knowledge is required for its diagnosis. Notification of cows showing symptoms of the disease is required, because when once an animal is recognised as tuberculous there is no knowing when the tubercular process may not invade the udder. Dr. Sims Woodhead, in his investigations for the Royal Commission (1890), was impressed with the fact that the spread of tubercle in the udder goes on with most alarming rapidity, and he noticed that on several occasions the disease had become distinctly developed between fortnightly inspections carried on along with a veterinary surgeon.

As an example of local powers, I am giving those recently obtained by Brighton, as we may consider them typical of those which will soon be adopted by other towns.

POWERS OBTAINED BY BRIGHTON UNDER ACT OF PARLIAMENT.

Milk-Supply.

1. Every person who knowingly sells or suffers to be sold or used for human consumption within the Borough the milk of any cow which is suffering from tuberculosis of the udder shall be liable to a penalty not exceeding £10.

2. Any person the milk of the cows in whose dairy is sold or suffered to be sold or used for human consumption within the Borough who, after becoming aware that any cow in his dairy is suffering from tuberculosis of the udder, keeps or permits to be kept such a cow in any field, shed, or other premises along with other cows in milk shall be liable to a penalty not exceeding £5.

3. Every dairyman who supplies milk within the Borough and has in his dairy any cow affected with or suspected of or exhibiting signs of tuberculosis of the udder shall forthwith give written notice of the fact to the Medical Officer of Health, stating his name and address, and the situation of the dairy or premises where the cow is. Any dairyman failing to give such notice as required by this subsection shall be liable to a penalty not exceeding 40s.

4. (*a*) It shall be lawful for the Medical Officer of Health or any person provided with and if required exhibiting the authority in writing of such Medical Officer of Health to take within the Borough for examination samples of milk produced or sold or intended for sale within the Borough.

(*b*) The like powers in all respects may be exercised outside the Borough by the Medical Officer of Health or such authorized person if he shall at first have obtained from a justice having jurisdiction in the place where the sample is to be taken an order authorizing the taking of samples of the milk, which order any such justice is hereby empowered to make.

5. (*a*) If milk from a dairy situate within the Borough is being sold or suffered to be sold or used within the Borough, the Medical Officer of Health or any person provided with and if required exhibiting the authority in writing of the Medical Officer of Health may, if accompanied by a properly-qualified veterinary surgeon, at all reasonable hours, enter the dairy and inspect the cows kept therein, and if the Medical Officer of Health or such person has reason to suspect that any cow in the dairy is suffering from tuberculosis of the udder, he may require the cow to be milked in his presence and may take samples of milk, and the milk from any particular teat, shall, if he so requires, be kept separate, and separate samples thereof be furnished.

(*b*) If the Medical Officer of Health is of opinion the tuberculosis is caused or is likely to be caused to persons residing in the Borough from consumption of the milk supplied from a dairy situate within the Borough, or any cow kept therein, he shall report thereon to the Corporation, and his report shall be accompanied by any report furnished to him by the veterinary surgeon, and the Corporation may thereupon serve on the dairyman notice to appear before them within such time, not less than twenty-four hours, as may be specified in the notice to show cause why an order should not be made requiring him not to supply any milk from such dairy within the Borough until the order has been withdrawn by the Corporation.

(*c*) If the Medical Officer of Health has reason to believe that milk from any dairy situate outside the

Borough from which milk is being sold or suffered to be sold or used within the Borough is likely to cause tuberculosis in persons residing within the Borough, the powers conferred by this subsection may, in all respects, be exercised in the case of such dairy, provided that the Medical Officer of Health or other authorized person shall first have obtained from a justice having jurisdiction in the place where the dairy is situate an order authorizing such entry and inspection, which order any such justice is hereby empowered to make.

(*d*) Every dairyman and the persons in his employment shall render such reasonable assistance to the Medical Officer of Health or such authorized person or veterinary surgeon as aforesaid as may be required by such Medical Officer of Health, person, or veterinary surgeon, for all or any of the purposes of this subsection, and any person refusing such assistance or obstructing such Medical Officer of Health, person, or veterinary surgeon, in carrying out the purposes of this subsection shall be liable to a penalty not exceeding £5.

(*e*) If in their opinion the dairyman fails to show cause why such an order may not be made as aforesaid, the Corporation may make the said order, and shall forthwith serve notice of the facts on the County Council of any administrative county in which the dairy is situate, and on the Local Government Board, and if the dairy is situate outside the Borough, on the Council of the Borough or County District in which it is situate.

(*f*) The said order shall be forthwith withdrawn on the Corporation or their Medical Officer of Health being satisfied that the milk-supply has been changed or that it is not likely to cause tuberculosis to persons residing in the Borough.

(*g*) If any person after any such order has been made supplies any milk within the Borough in contravention of the order, or sells it for consumption therein, he shall be liable to a penalty not exceeding £5, and if the offence continues to a further penalty not exceeding 40s. for every day during which the offence continues.

(*h*) The dairyman shall not be liable to an action for breach of contract if the breach be due to an order under this subsection.

(*i*) The dairyman may appeal against an order of the Corporation under this subsection, or the refusal of the Corporation to withdraw any such order, either to a Petty Sessional Court, having jurisdiction within the Borough, or at his option, if the dairy is situate outside the Borough, to the Board of Agriculture, who shall appoint an officer to hear such appeal. Such officer shall fix a time and place of hearing within the Borough, and give notice thereof to the dairyman and the Town Clerk not less than forty-eight hours before the hearing. Such officer shall, for the purposes of the appeal, have all the powers of a Petty Sessional Court.

The Court or the Board of Agriculture may at any stage require payment to them by the dairyman of such sum as they deem right to secure the payment of any cost incurred by the Board of Agriculture in the matter of the appeal.

The Court or the Board of Agriculture, as the case may be, may confirm, vary, or withdraw the order which is the subject of the appeal, and may direct to and by whom the cost of the appeal (including any sum paid or payable to the Board of Agriculture as aforesaid) are to be paid, but pending the decision of the appeal the order shall remain in force, unless previously withdrawn by the Corporation.

(*j*) If an order is made without due cause, or if the

Corporation unreasonably refuse to withdraw the order, the dairyman shall, if not himself in default, be entitled to recover from the Corporation full compensation for any damage which he has sustained by reason of the making of the order or of the refusal of the Corporation to withdraw the order.

The Court or the Board of Agriculture may determine and state whether an order, the subject of appeal, has been made without due cause, and whether the Corporation have unreasonably refused to withdraw the order, and whether the dairyman has been in default.

Any dispute as to the fact whether the order has been made or maintained without due cause, or as to the fact of default where any such fact has not been determined by the Court or Board of Agriculture, or as to the fact of damage, or as to the amount of compensation, shall be determined in the manner provided by Section 308 of the Public Health Act, 1875, and that section shall accordingly apply and have effect as if the same were herein enacted, and in turns made applicable to any such dispute as aforesaid.

6. Offences under this section may be prosecuted, and penalties may be recovered by the Corporation before the Petty Sessional Court having jurisdiction in the place where the dairy is situate or the offence is committed, and not otherwise.

7. All expenses incurred by the Corporation in carrying into execution the provisions of this section shall be chargeable on a district fund and general district rate, and the Corporation may also charge upon the same rate any expenses incurred by them in the application by a veterinary surgeon of the tuberculin or other reasonable test for discovering tuberculosis in any cow whose milk is, or was, recently being supplied within

the Borough. Provided that no such test shall be applied except with the previous consent of the owner of such cow.

8. This section may be carried into execution by a Committee of the Corporation formed in accordance with, and subject to, provisions of the fourth schedule to the Diseases of Animals Act, 1894, except that the Committee shall consist wholly of members of the Corporation.

52. Public notice of this part of the Act shall be given forthwith after the passing of this Act in two local papers circulated in the Borough, and by a notice affixed outside the offices of the Corporation, and by handbills or such further means as the Corporation deem reasonable for conveying notice of the provisions of this part of the Act to persons affected or likely to be affected thereby. A copy of a newspaper or the newspapers containing the advertisement shall be sufficient evidence that provisions of this section have been complied with, and this part of the Act shall come into operation at such time not being less than one month after the first publication of such an advertisement and notice as aforesaid as the Corporation may fix.

CHAPTER VII

MEAT INSPECTION

In a review of the conditions affecting meat inspection in this country, as compared with those prevailing abroad, it should be remembered that there are conspicuous differences between the two. In the first place, abattoirs are much more common on the Continent than in the United Kingdom. Whereas in England and Wales their number is about 80, in Prussia it is 321, and in the other states which form the German Empire there must be at least another 300, making a total of over 600 altogether. In Würtemberg and Baden, most of the little towns with a population of 3,000 possess abattoirs; but it has been estimated that, not to mention smaller districts, there are in Germany over 350 districts with more than 5,000 inhabitants that are as yet unprovided with public slaughter-houses. It would be a mistake, therefore, to say that their use is universal, and, indeed, it is considered in Prussia that, while as regards towns meat inspection is satisfactory, in many rural districts the condition of things in this respect leaves much to be desired.

In France, Belgium, and Austria it is probable that all towns of any magnitude are provided with public abattoirs.

In Prussia their use has been largely brought about by a law passed in 1865 to compel all slaughtering to be carried out in a public abattoir, as soon as one has been erected in the district. Power was further given to the local authority to draw up regulations requiring all cattle to be examined by an expert before and after slaughter.

The owners of private slaughter-houses were compensated to the extent of the real loss sustained by them in the withdrawal from their original purpose of the buildings and fittings. No compensation was given for mere disturbance of business.

All the slaughter-houses are self-supporting, the charges that are imposed on the butchers being so calculated as to cover working expenses and to defray interest on capital and sinking fund. They vary from 2s. to 5s. for the slaughter of cattle, 1s. for calves and sheep, and 1s. to 2s. for pigs. In addition to this, there is a charge for the expert examination amounting to 1s. to 2s. for cows, 6d. for sheep, and 1s. for pigs, which includes a microscopical examination of the flesh for trichinosis.

The advantages of public slaughter-houses over private are many. A greater uniformity of inspection is obtained, because efficient inspection of meat in private slaughter-houses, when scattered about a town, can only be secured at great cost. Better provision can be made in them for the housing of the animals, pending their slaughter. When the cattle-market is adjacent to the public slaughter-house, as it always should be, and both are in direct communication with the main railway lines, the driving of cattle through the main throughfares is done away with. In connection with slaughtering, many trade processes for the utilization of the waste products are carried on, such as bone-boiling, gut-scraping, the extraction of albumin from the blood, and fat-melting, which, if not carried out with care, are productive of grave nuisance, and it is highly desirable that they should be centralized in a public slaughter-house as much as possible.

If any attempt is to be made in this country to utilize by sterilization or cooking the flesh of animals affected to a certain extent with tuberculosis, or to utilize profitably, for trade purposes, carcases so badly affected with tuberculosis or other disease that they must be wholly condemned, the plant necessary for carrying this out must be centralized in the public slaughter-house. To show what can be done by these methods, when efficiently supervised, the authorities in Stolp, in Prussia, recovered 30 per cent. of the full value of the condemned carcases.

Lastly, the knowledge gained in them as regards the nature of and extent to which diseases prevail among animals used for food can be tabulated, and such knowledge must prove useful in many ways.

Public slaughter-houses should be built and controlled by the local authorities themselves. In not a few instances abroad they are in the hands of butchers' associations, but this course is not to be recommended.

It is probable that the objections raised by butchers in England to the erection of public slaughter-houses, on the ground of the inconvenience to the trade and the belief that their erection would lead to the falling-off in the killing of home-fed cattle and an increase in the importation of dead meat from the colonies, would disappear when once they were established. At any rate, in Scotland the butchers prefer public to private slaughter-houses, for the simple reason that they have tried them and been made sensible of their advantages. The general public, it is certain, would prefer to have meat from public slaughter-houses, where it is known that the inspection is adequate.

The second point in which there is a marked difference between the conditions at home and on the Continent as regards meat inspection is the far larger consumption in England of imported meat than is the case in any country on the Continent.

A distinction must be drawn between animals that are imported from oversea and killed at the port of entry, and the animals killed in the distant countries and imported in a frozen or chilled condition.

An important question arises: Is there less tuberculosis among these imported cattle than there is among the home-fed?

The evidence given before the Royal Commission by those whose work brings them most into contact with such imported animals was that there was considerably less disease among them—a fact which was attributed to their open-air life on the prairies, the small number of cows among those sent over, and to the fact that they are selected animals.

Nor should it be forgotten that in some of the countries—as, for instance, the United States—the animals are all inspected. Some doubt has been cast on the value of this inspection; and certainly, if the work is done thoroughly, it must require an enormous organization and entail great expense. From the report of the Chief of the Bureau of Animal Industry (Dr. D. E. Salmon) for 1895, it is evident that an organized attempt has been made in the United States to cope with the matter, and every credit should be given the Government there for it.

Whereas in 1892 in the abattoirs 3,800,000 head of cattle were inspected, in 1896 the number inspected amounted to 23,275,000, and in stock-yards to 12,641,000.

Of cattle alone 7,529,523 were examined before slaughter, and 12,356 were condemned. Post-mortem examination was made of 3,995,461 cattle, of which 8,757 were condemned. Since March 15, 1897, under an order of the United States Department of Agriculture, all meat which is transported to European ports must be accompanied by a certificate issued by an inspector of that department.

From a recent report by Russell and Hastings, of the Wisconsin Agricultural Experimental Station, of tests of cattle for tuberculosis which have been made in the United States, the following summary is presented:

STATISTICS OF TESTS FOR TUBERCULOSIS IN THE UNITED STATES.

State.	Number Tested.	Number Tubercular.	Per Cent. Tubercular.
Vermont - - - - -	60,000	2,390	3·9
Massachusetts - - -	24,685	12,443	50·0
,, entire herds -	4,093	1,080	26·4
Connecticut - - - -	6,300	—	14·2
New York, 1894 - - -	947	66	6·9
,, 1897-98 - -	1,200	163	18·4
Pennsylvania - - - -	34,000	4,800	14·1
New Jersey - - - -	2,500	—	21·4
Illinois, 1897-98 - - -	929	—	12·0
,, 1899 - - - -	3,655	560	16·32
Michigan - - - -	—	—	13·0
Minnesota - - - -	3,430	—	11·1
Iowa - - - - -	873	122	13·8
Wisconsin:			
Experiment station tests—			
Suspected herds - -	323	115	35·6
Non-suspected herds -	935	84	9·0
State veterinarian's tests—			
Suspected herds - -	588	191	32·5
Tests of local veterinarians under state veterinarian cattle intended for shipment to states requiring tuberculin certificate - - -	3,421	76	2·2

The State Veterinarian of Pennsylvania, Dr. Pearson, thinks that not over 2 per cent. of the cattle of that state are tuberculous, and probably if a general test of all the cattle of the other states mentioned was made we should find a very much smaller proportion tubercular than is indicated by this tabular statement. The explanation of the high percentages that have been given is found in the fact that it has been for the most part suspected herds which have been tested. Admitting that the greater part of these percentages are too high, they are still sufficient to demonstrate the wide distribution of tuberculosis and its comparative frequency.

Beef-cattle, as they come to the large packing-houses, are yet comparatively free from tuberculosis. Of 4,841,166 cattle slaughtered in the year 1900 under Federal Inspection, but 5,279, or 0·11 per cent., were sufficiently affected to cause the condemnation of any part of the carcase. Of 23,336,884 hogs similarly inspected, 5,440 were sufficiently affected to cause condemnation of some part of the carcase. This is equal to 0·023 per cent., or slightly more than one-fifth of the proportion found in beef-cattle.

The slaughter-house statistics of all countries show that the percentage of affected hogs increases as the disease becomes more common in cattle, so that we must consider not only the effect of the disease on beef- and milk-producing animals, but also upon hogs. The disease is more acute with hogs than with cattle, and there is a much greater tendency to generalization, and consequently the parts used for human food are more likely to be affected; and if there is a possibility of communicating the disease through the meat, the danger is increased by this peculiarity of these animals.

Unfortunately, however, both in North and South

America, as the continents are getting settled up, tuberculosis among cattle shows an increase.

Tuberculosis in cattle, as found by post-mortem examination, generally occurs in one of two forms: (1) Where organs and their glands only are affected; (2) when there has been invasion of the serous membranes. The former is the more frequent form in cattle, and the latter is almost invariably secondary to disease of the organs.

Tuberculosis of the lining membranes of the chest and abdominal cavities shows itself by the formation of a number of small lumps, or 'tubercles,' from the appearance of which the familiar name of 'grapes' has been given. Sometimes these grow to an enormous size, so that they weigh several pounds; at others the appearance presented is that of a roughening or velvety appearance of the wall, owing to the coalescence of a large number of small tubercles. Of the organs, those most frequently affected are the lungs, then those of the digestive tract, and lastly the organs of generation. From a primary infection all the organs of the body can be secondarily infected.

The tubercles are formed by the life processes of the bacilli, which live upon and bring about changes in the tissues, and in all cases the bacilli can, if proper care is taken, be discovered. When the tubercles first appear they resemble little gray bodies, each of about the size of a millet-seed, or rather larger, and from this resemblance the name 'miliary' tuberculosis has arisen. They rapidly increase in size by the multiplication of the bacilli, and by the formation of secondary foci in the neighbourhood of the primary ones.

Under the microscope, the appearance of a tubercle is very characteristic, from the alteration in the character of the cells of the tissue which is brought about.

They are, however, unprovided with bloodvessels, and consequently undergo fatty changes, or caseation, as it is called. Sometimes the broken-down tissue hardens by the deposition of lime-salts, and the affected part gets shut off from the rest, and gradually heals. On the other hand, if the bacteria which cause pus gain an entrance, as is not unfrequently the case, then an abscess will be formed.

In meat inspection the point that it is of the utmost importance to decide is whether an animal is affected with localized or generalized tuberculosis. The term 'localized' is used when the disease is limited to one organ, or spreads to another organ by contiguity, or by the lymphatic channels, or through the portal circulation (*i.e*, the circulation between the intestinal tract and the liver), but not by means of the general blood-stream of the body. As examples of it are tuberculosis of the retropharyngeal lymphatic glands with tuberculosis of the lungs and bronchial lymphatic glands, tuberculosis of the intestines and mesenteric lymphatic glands, tuberculosis of the lungs and pleura, tuberculosis of the intestines and liver.

By 'generalized' tuberculosis is meant the spread of the disease by the passage of tubercle bacilli into the main blood-stream or into the thoracic duct, and their conveyance thence to different organs and parts of the body, such as the lungs, liver, spleen, kidneys, bones, and muscular tissue. If the bacilli in this case enter in large numbers into the blood-stream, then acute miliary tuberculosis (galloping consumption) results; but it by no means follows that in generalized tuberculosis all the organs and tissues become equally infected. Some tissues offer a particular resisting power to the organisms. The lungs are always attacked, then come in order the abdominal organs, the serous membranes, the lymphatic glands of the muscular tissue, the udder, kidneys, and lastly the bones.

Seeing, then, the importance of determining in a tuberculous carcase whether the disease is generalized or not, it is necessary to make a systematic examination of the organs and chains of lymphatic glands, which give the best indications of the presence of this condition. These are the lungs, liver, spleen, kidneys, the axillary glands, and the internal and external iliac glands.

In the case of dressed carcases consigned without offal the condition of the lymphatic glands ought to be particularly noted.

Professor Ostertag, of Berlin, the highest authority on the subject of meat inspection in Germany, considered that affections of the serous membranes, when it is a question of generalized tuberculosis, play a very much less important rôle than the organs named. So much so, indeed, is this the case, in his opinion, that in passing judgment on flesh their condition should be disregarded, because tuberculosis on them is a local condition. The one exception to this is when the disease starts from the uterus. The serous membranes may be most extensively affected without causing any infection of the lungs, liver, or spleen; and, on the other hand, there may be extensive miliary tuberculosis of the lungs, etc., without any sign of disease on the pleura or peritoneum. Tuberculosis of the serous membranes only rarely leads to a generalization of the disease.

The examination of the important organs should be carried out by examining first the organs least likely to be affected, and not, as is usually the case, those which are most likely to be the seat of the tubercular process. The reason for this is that the knife will probably, if the latter method be adopted, carry infective material from a diseased to a healthy organ. That this is not a risk that may be neglected was proved by the feeding experiments carried out by Dr. Sidney Martin for the Royal Commission, 1890. Every unnecessary incision into tuberculous deposits should be avoided.

The following tables and method of inspection from the report of Mr. A. M. Trotter, Veterinary Inspector, Glasgow, are instructive, and serve as a very useful guide to those who have similar duties to perform:

TABLES OF HOME ANIMALS KILLED AT GLASGOW, 1903.

Species.	Slaughtered.	Tubercular.							
		Affected.		Carcases Partially Destroyed.		Measures Adopted.			
						Carcases Totally Destroyed.		Carcases Passed.	
	No.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Cattle	47,362	7,484	15·80	771	10·30	1,096	14·64	5,617	75·05
Calves	2,325	7	0·30	—	—	4	57·14	3	42·86
Sheep	271,385	1	0·0003	—	—	1	100 00	—	—
Swine	53,483	2,132	3·98	—	—	75	3·52	2,054	96·48

The tables which have been compiled from prices ruling at the Central Meat Market, London, during 1903, show approximately the difference in the market value of the different classes of meat:

BEEF.

Scotch—short sides		- - -	6½d. per lb.
American—hind quarters;	refrigerated	-	5½d. ,,
Australian ,,	frozen	-	3½d. ,,
River Plate ,,	,,	-	4d. ,,
New Zealand ,,	,,	-	4d. ,,

Mutton.

Scotch	- - - - -	7½d. per lb.
English	- - - - -	6¾d. ,,
Ewes	- - - - -	5½d. ,,
Dutch	- - - - -	5¼d. ,,
New Zealand—frozen	- - -	4d. ,,
Australian ,,	- -	3¼d. ,,
River Plate ,,	- - -	3½d. ,,

It will be noted that foreign and colonial meat is lower in price than home meat, and consequently butchers are induced to purchase, to the detriment of home breeders and feeders.

TABLE SHOWING THE NUMBER OF CARCASES OF HOME AND FOREIGN ANIMALS TOTALLY AND PARTIALLY DESTROYED AT GLASGOW ON ACCOUNT OF TUBERCULOSIS DURING THE YEARS 1901, 1902, AND 1903.

			Cattle.						Swine.	Sheep.	Total.
			Oxen.	Bulls.	Cows.	Heifers.	Calves.	Total.			
Home.	1901	Totals -	15	23	918	11	3	970	73	—	1,043
		Partials	35	26	596	6	—	664	1,156	—	1,820
	1902	Totals -	33	27	1,128	13	1	1,202	61	—	1,263
		Partials	60	38	749	17	—	864	1,305	—	2,169
	1903	Totals -	33	23	1,012	28	4	1,100	75	1	1,176
		Partials	73	38	638	22	—	771	1,905	—	2,676
	1901-3	Totals -	81	73	3,058	52	8	3,272	209	1	3,482
		Partials	168	102	1,984	45	—	2,299	4,366	—	6,665
Foreign.	1901	Partials	2	7	—	—	—	9	—	—	9
	1902	Totals -	2	—	1	—	—	3	—	—	3
		Partials	3	4	2	—	—	9	—	—	9
	1903	Totals -	1	2	—	—	—	3	—	—	3
		Partials	5	6	—	—	—	11	—	—	11
	1901-3	Totals -	3	2	1	—	—	6	—	—	6
		Partials	10	17	2	—	—	29	—	—	29

A record of the seat of the tubercular lesions in each animal affected was kept, and is here tabulated :

HOME ANIMALS.

Cattle.	Pleural Cavity.	Peritoneal Cavity.	Both Cavities.	Other Parts of the Body.	Total.
Oxen -	474	77	275	297	1,123
Bulls -	512	54	222	180	968
Cows -	2,081	251	2,657	247	5,236
Heifers -	61	6	66	24	157
	3,128	388	3,220	748	7,484
Calves -	3	—	4	—	7
Sheep -	—	—	1	—	1
Goats -	—	—	—	—	—
Swine -	40	109	188	1,796	2,133
	3,171	497	3,413	2,544	9,625

TABLE SHOWING THE VARIOUS ORGANS AFFECTED IN CATTLE KILLED AT GLASGOW, 1903.

	Lung Substance.	Pulmonary Lymphatic Glands.	Glands and Lungs.	Hearts.	Bowels.	Stomach.	Livers.	Hepatic Lymphatic Glands.	Livers and Glands.	Spleens.	Kidneys.	Udders.	Heads.
Oxen -	19	345	182	—	166	18	42	77	27	10	5	—	374
Bulls -	31	423	199	—	189	18	26	71	28	10	3	—	356
Cows -	289	1,379	1,865	1	1,657	232	201	305	115	118	32	7	1,415
Heifers	2	36	47	—	27	5	5	12	5	4	—	—	48
Calves	—	2	1	—	—	—	—	1	—	—	—	—	1

This table may appear to show a great pecuniary loss to the trade through the total or partial seizure of so many carcases on account of tuberculosis. These figures are misleading, in that they give an exaggerated idea of the severity of the standard by which tubercular carcases are adjudicated, for these tables were compiled simply to show the prevalence of tuberculosis affecting the lower animals. Many of these animals were consigned to the different abattoirs on account of their unthrifty condition, and might, with equal accuracy, be returned as having been affected with some other morbid condition. All carcases during the seven consecutive weeks ending June 18, 1904, which were totally destroyed in Moors Street abattoir on account of tuberculosis were weighed and tabulated as follows: From May 2 to June 18, 1904, there were destroyed, on account of tuberculosis, 150 carcases, weighing a total of 164 cwt. 3 qr. 22 lb., or an average of 3 cwt. 0 qr. 11 lb. per carcase.

5	carcases	weighed from	1 to 2	cwt.
83	,,	,,	2 to 3	,,
41	,,	,,	3 to 4	,,
11	,,	,,	4 to 5	,,
8	,,	,,	5 to 6	,,
2	,,	,,	6 to 7	,,
150				

Inspection after Slaughter.

If the inspection is made at the time of the slaughter, the organs will be examined as they are removed by the butcher in his customary way of dressing, which is much the same in all animals.

To prevent repetition, I may mention a rule to be observed in the examination of all organs. Their size, shape, colour, and consistency should always be criticised, also their outlines and relationships, after which one may search for pathological changes. A regular inspection is of extreme importance, as it will help one to trace the development and course of most diseases.

The Feet.—These require examining for injuries, septic changes, morbid growths, eruptions of foot-and-mouth disease, etc.

Intestines and Mesenteric Glands.—The bowels are used as a capsule for our black puddings and polonies. Their calibre and peritoneal covering and the thickness of their walls should be noted.

The mesenteric lymphatic glands in bovines are to be found running along the mesentery near its distal border, about 4 inches from the attachment to the small intestines. Their examination should never be overlooked in conducting a post-mortem examination for evidence of tuberculosis, and especially in proving the tuberculin test. The intestines should always be condemned when their peritoneal covering or lymphatic glands are diseased.

The Stomachs.—The first stomach is commonly called the belly, and after it has been scalded, scraped, and boiled, it constitutes tripe. The third stomach is not used, but the fourth is also converted into tripe. The average weight of the first stomach is from 16 to 20 pounds. Some lymphatic glands will be found in the fat near the œsophageal entrance, and in the fissure on its anterior surface. The peritoneal surface of the stomachs is frequently affected with tuberculosis, and the mucous membranes of the fourth stomach with worm tubercles, a description of which is given by Professor MacFadyean in the *Journal of Comparative Pathology*, vol. ix., p. 314.

The Liver.—The normal weight of the ox liver is about 10 to 12 pounds. It varies, however, very greatly, even in health. It is a common seat of disease, such as inflammatory changes resulting in fatty degeneration, cirrhosis, parasitic infection (fluke, hydatid cysts), abscesses, tumours (carcinoma, cavernous angeiomata, etc.), tuberculosis, and disseminated bacterial necrosis.

In the liver of the rabbit the parasitic infection known as coccidian disease is sometimes met with and mistaken for tubercule. The liver is studded with grayish-white nodules, varying in size from a pea downwards, with purulent contents, which are found on microscopical examination to contain great numbers of coccidium oviforme. The individual coccidia are egg-shaped bodies, possessing a shell wall with protoplasmic contents. In some seasons an epidemic form of this disease occurs in rabbit-warrens.

Disseminated bacterial necrosis has also been mistaken for tubercle. The two diseases, however, are quite easily distinguished. Briefly, in this disease necrosed patches or areas are irregularly distributed through the liver substance, varying in size from a walnut downwards, with a well-defined outline, which is not circular ; in colour the patch of dead tissue varies from brownish-yellow to a dirty gray, and in consistency it resembles putty or unripe cheese, is not purulent, and cannot be easily enucleated from the surrounding tissue. On the surface of the liver the nodules are slightly raised, yet somewhat flattened on their upper aspect and firm to the touch. The lymphatic glands will be free from tubercular deposit. It may be also said the liver is usually very much enlarged. The hepatic glands are to be found at the portal fissure.

The Spleen.—Commonly called the melt. Its external surface is frequently affected with tuberculosis, and occasionally the splenic pulp also. This organ is important in the diagnosis of anthrax ; particular attention should therefore be paid to its volume and consistency. Its lymphatic glands are usually left attached to the left side of the stomach.

Uterus.—Also termed the calf-bed, or lamb-bed, as the case may be. Inflammatory diseases, tuberculosis, and septic conditions are chiefly looked for.

Heart and Lungs.—These organs are removed from the chest, together with the mediastinal tissue and fat attached. It is important that the following lymphatic glands should be looked for, namely:

1. *Tracheal Glands.*—On the course of the trachea, on its upper surface.

2. *Cardiac Glands.*—At the base of the heart, and must be looked for before the organ is severed from the lungs.

3. *Bronchial Glands.*—At the bifurcation of the trachea into the two bronchii. The right gland is sometimes torn away, but the left is always to be found by cutting down on the left bronchial tube.

4. *Mediastinal Glands.*—This group of glands will be found in the form of a chain running in the mediastinal tissue between the right and left lungs on the œsophagus. They are of large size.

The lungs must not be stripped of their fat until these four groups of glands have been examined, otherwise they will be removed. Their examination is necessary in all inflammatory and blood diseases, and in tuberculosis they should never be overlooked. They are frequently found affected when this disease is not apparent in the lung tissue—an item to be remembered in making post-mortem examinations after the tuberculin test. All other diseases of the lungs and heart are, of course, to be looked for.

The Mammary Glands, or Udder.—The mammary glands are two in number, and are placed side by side on the middle line of the abdominal wall in front of the pubes. They form here a single mass, with a furrow between them; each gland consists of a fore- and hind-quarter. The term 'udder' is used to include both glands.

The udder of the cow when boiled constitutes an article of diet in the tripe-shop. The examination thereof is important. Each quarter should be criticised in respect to volume and consistency, and an incision should be made from the ampulla right through the whole gland, dividing it into halves. The milk-ducts and gland-tissue will then be well exposed, and its peripheral borders and ducts should be carefully examined.

The Lymphatic Glands of the Udder.—Situated at the supra-posterior border of each gland, near the entrance of the bloodvessels—that is to say, above the attachment of the hind-quarters. Their examination is extremely important in all inflammatory diseases, tuberculosis, and septic affections of the udder.

Pharyngeal Glands.—Situated at each end of the pharynx, and related to the inner surface of the great cornu of the hyoid bone, near its attachment to the skull. They are easily got at by placing the head on the table, face downwards, with its base towards you, the examiner raising the cut-end of the trachea with the left hand, feeling for the hyoid bone, and making the incision. They are frequently seen without any dissection when the tongue is removed.

Submaxillary Glands.—Found at the angle of the lower jaw, at the inner side of the attachment of the sterno-maxillaris.

Parotid Gland.—At the anterior border of the parotid salivary gland, resting on the masseter muscle.

Suboccipital Glands.—At the base of the occipital bone, near the condyles.

Mammary or Superficial Inguinal.—These have been already alluded to. In the bullock they are to be found at the base of a mass of fat known as the 'cod' in the inguinal region, and are readily brought to view by making a bold incision in this fat from the inner surface and cutting down upon the abdominal tunic. In the pig these glands are to be found in the subcutaneous fat above and a little posterior to the last teat in the inguinal region.

Deep Inguinal Glands.—This large group of glands is to be found at the pelvic inlet, in the distal edge of the loin suet and on the course of the external iliac artery, about midway between its departure from the aorta and its entrance into the thigh muscles.

Iliac Glands (External and Internal).—These are related to the arteries of the same name at their origin about the last lumbar vertebra.

Sacral Glands.—Situated at the flow of the sacrum between the two internal iliac vessels.

Lumbar Glands.—These may be described as a superficial and deep set. The superficial chain, which perhaps belong to the large bowels or their mesentery, are to be found in the fat in front of the large vessels in this region. The deeper set are situated close on to the lumbar vertebræ.

Another group of glands is to be found in the fat of the loins, resting on the muscles of the flank a few inches anterior to the deep inguinal, and at the point where the circumflex iliac artery divides into its anterior and posterior branches.

Renal Glands.—At the origin of the renal artery, about the second lumbar vertebræ.

Cœliac Glands.—Between the pillars of the diaphragm at the origin of the cœliac axis.

Popliteal Glands.—These glands are to be found in the popliteal space, and are readily got at by cutting through the thigh muscles immediately above and posterior to the stifle-joint (femoro-patellar articulation) on the track of the femoro-popliteal artery.

Precrural Glands.—Of large size, and found in the groin fascia. The landmarks for its section are at the superior border of the panniculous carnosus, a few inches from its posterior angle at the groin and the fascia intervening between this point and the anterior muscles of the thigh.

Subdorsal Glands.—These will be found on each side of the aorta, from about the fifth to the last dorsal vertebræ. Most of these glands are frequently removed in dressing, but two or three will be generally found from the tenth to the thirteenth vertebræ.

Intercostal Glands.—Situated between the ribs at their junction with the vertebræ. In health they are very small, probably not larger than a pea. In disease, however, they may be the size of a hazel-nut.

Suprasternal Glands.—Situated between the costal cartilages of the first six ribs, under the triangularis sterni, on the course of the internal thoracic artery. In front of the thoracic side of the insertion of the diaphragm, across the ensiform cartilage, will be found a gland superficially placed.

Prepectoral Glands.—This large group of glands will be found at the entrance of the chest, on the surface of the first rib, if not removed by the butcher. A deeper gland, however, will be always found in the fat immediately anterior to the first rib, and beneath the scalenus muscle, resting upon the posterior deep pectoral.

Brachial Glands.—These glands cannot be conveniently examined unless the fore-quarter is divided longitudinally. They can, however, be exposed by the moving of a portion of a second rib, when they will be found in the fat beneath, resting on the teres major, near its insertion into the humerus.

Prescapular Glands.—Found in the mass of fat immediately anterior to the shoulder-joint, under the mastoido-humeralis muscle.

An examination of the lymphatic glands is extremely important in tracing the origin, course, and extent of disease; consequently, their normal size, consistency, and colour should always be taken into account. There are very few diseases or conditions that render the carcase of any animal unfit for human food but what produce some abnormal changes in these glands.

Sectioning the carcase in the case of cattle should be done as far as possible in a customary manner, as undue mutilation is undesirable, should any portion of the carcase be passed. Different districts have slightly different methods, and the butcher can generally be allowed to divide in his own way so long as it permits of the purposes of inspection.

In Manchester the fore- and hind-quarters are separated by commencing at the junction of the first and second lumbar vertebræ, or the sixth joint from the sacrum. The muscular area exposed is not large, and only occasionally will it suffice for the investigator. The hind-quarters should next be cut by making a complete section through the muscles of the thigh, commencing about an inch or so from the ischio-pubic symphysis, sawing through the head of the thigh bone (femur), after which the knife is directed in a longitudinal manner through the muscles of the flank. This is a customary section in the trade, and it is most satisfactory for the examiner, inasmuch as it exposes to view a large muscular area, and one which is frequently the seat of abnormalities.

The fore-quarters should be divided by a longitudinal incision down through the shoulder-joint in order to expose the thick muscles and the joint cavity. After this section it is easy to expose the brachial and prescapular lymphatic glands.

On the Continent hardly any live animals or dead meat are imported from abroad, the home-fed animals sufficing for the supply. But, naturally, into the large towns a good many carcases of animals that have been killed in the country districts are brought, and in these towns regulations have been made for the careful examination by experts of such meat before it can be offered for sale. Special stations are appointed near the main railway-stations and roads to which such meat is brought for its examination. The following are the main points of the regulations in force in Berlin as to the examination of this imported dead meat:

1. The stations are under the control of the director of the slaughter-house, and in each one a veterinary surgeon is placed in charge.

2. No less amount than whole quarters of an animal may be imported, and they must always be accompanied by the organs and head of the animal.

3. A certificate from a member of the police or from a veterinary surgeon must be brought, stating that the animal had been inspected before slaughter, and was not affected with contagious disease.

4. No meat can be removed from the station until it has been stamped as fit for food.

5. The charge for examination must be fixed so as to cover the working expenses of the station.

6. A careful register must be kept of all the conditions leading to the seizure of the meat.

Similar regulations are enforced by the municipal authorities of many towns abroad. In Copenhagen, indeed, where all the meat, as is universally the case abroad, is stamped, two stamps of different colours are employed, one for first-class meat, and another for that which is, in the opinion of the inspector, of second-class quality, and this latter stamp is used largely in the case of imported dead meat.

The stamping of the meat is very easily done, and if it were applied in England as it is abroad, it would remove a very just complaint of agriculturists, that foreign meat under the guise of the best British fed is daily sold in many shops to the loss and detriment of the home feeder.

It is absolutely necessary that there should be meat inspection, first, to protect human health from the danger of eating meat that might prove injurious, and, secondly, to give an assurance to the public that what they buy is what it purports to be.

Butchers themselves quite recognise the importance and value of inspection, and would welcome it provided it were carried out by competent officials.

To be effective, meat inspection must extend to the animal both before and after slaughter, because, if inspection is deferred until after the organs are removed and only the carcase remains, the most valuable indications whereby the nature of the meat may be judged will have been destroyed.

Another advantage which may accrue from the inspection of meat, which has been almost entirely lost sight of hitherto in this country, is the knowledge which a careful compilation of the statistics of meat inspectors enables the authorities to gain of the extent to which various diseases affect domestic animals, and what organs become chiefly affected with the diseases.

In no disease has this knowledge been more wanted than in tuberculosis, but the reports of most medical officers of health may be searched in vain for information as to the relative proportion in which bullocks, heifers, bulls and cows, calves and pigs, are affected with the disease. All the information usually given on the subject is that so many carcases or so many pounds of meat were seized and destroyed as unfit for food.

On the Continent, especially in Germany, France, and Belgium, very great care is taken to tabulate, in the annual reports of the Director of the Public Slaughter-houses, all information which would help the authorities in gaining a better knowledge of the diseases affecting domestic animals; and that the reader may see the form which this information takes, especially in relation to tuberculosis, the following examples are taken from the annual reports of the abattoirs in Leipzig:

LEIPZIG, 1897.

Kind of Animal.	Number Slaughtered.	Of which were Tuberculous.	
		Number.	Per Cent.
Oxen	9,131	3,205	35·10
Bullocks and heifers	1,493	306	20·49
Cows	10,355	5,068	48·09
Bulls	6,212	1,320	21·24
Total Cattle	27,191	9,899	36·40
Calves	67,961	139	0·20
Sheep	49,559	8	0·01
Goats	235	—	—
Pigs	132,062	3,679	2·78
Horses	1,530	8	0·52

EXTENT OF THE TUBERCULOUS PROCESS.

Kind of Animal.	Localized and Limited to				Generalized and Extending to					
	One Organ only.	Several Organs in the same Body Cavity.	Organs of both Body Cavities.	Total of Localized Cases.	Spleen.	Kidneys.	Udder.	Bones.	Glands of the Muscular Tissue.	Total of Generalized Cases.
Cattle	7,018	339	1,878	9,235	202	462	93	54	128	664
Calves	44	—	9	53	79	35	4	9	21	86
Sheep	5	—	1	6	2	—	1	—	—	2
Goats	—	—	—	—	—	—	—	—	—	—
Pigs	851	8	1,343	2,202	1,368	496	140	161	173	1,477
Horses	4	—	2	6	2	2	—	—	—	2

It should be remembered, too, that in all the instances given it is the inspection post-mortem merely that has revealed the presence of disease, and that doubtless the number would have been increased had the tuberculin test been used on the animals instead.

In Germany, France, and Belgium—and, indeed, in most of the countries abroad—it has been held for years that veterinary surgeons alone ought to have the final decision as to what should and what should not be condemned for food, and it is owing to this fact that the views held abroad on the subject of tuberculous meat are so much in advance of those in this country. It is curious that the plea of expense should be raised in a rich country like Great Britain against the employment of veterinary surgeons as meat inspectors, when in a comparatively poor country such as Germany their employment is almost universal.

In Germany it is held that meat inspection is no insignificant branch of science, but that it requires for its complete mastery and proper exercise a varied knowledge and a thorough practical training. It is not, however, considered enough that a veterinary surgeon, to be competent for the work, should merely have passed his examinations for his diploma (of which the theory of meat inspection forms a part), but that he should, in addition, undergo a special training in a public slaughterhouse.

In Belgium and France, also, the stringent laws that have been passed on the subject of meat inspection constitute members of the veterinary profession the final arbiters on questions of meat inspection, and require that they shall be placed at the head of public slaughterhouses.

In Belgium, where the law requires that all meat should be inspected before consumption, it is not possible that veterinary surgeons should be able, unaided, to inspect the whole of the animals killed, and consequently there are placed under them inspectors of meat who have no veterinary qualification.

Their duty is, however, not to condemn, but to reserve any carcases of animals which they suspect for the inspection of the veterinary surgeon. But to carry out this limited sphere they must pass an examination in the following subjects:

1. Knowledge of the laws and regulations dealing with meat inspection.
2. Description of the animals used for human food.
3. The names and situation of the different organs and regions of the body.
4. Signs of health and disease in animals used for food, both when alive and after slaughter.
5. The characters of fresh meat, organs, fat, and blood, as well as of the different preparations made from them,

as to the conditions rendering them fit or unfit for human consumption.

6. Knowledge of the abnormal conditions laid down in regulations, in regard to which he can act on his own responsibility, and of those in which he must summon the aid of a veterinary surgeon without delay.

The conditions in which he can take action himself are limited to the flesh or organs when affected with abscesses, cysts, chronic changes in the visceral organs, and adhesions or growing together of organs naturally distinct. In all cases of tuberculosis he must summon a veterinary surgeon.

CHAPTER VIII

DISPOSAL OF AFFECTED CARCASES

When the interchangeability of human and bovine tuberculosis first became an established fact, it was only natural that an extreme view should have been taken of the danger to man from the consumption of the meat of animals affected with tuberculosis. This view was advocated with great energy by M. Arloing, Director of the Veterinary College in Lyons, at the Congress on Tuberculosis held at Paris in 1888, and led to the adoption of a resolution that the flesh of animals affected with tuberculosis in any degree should be condemned. There can be little doubt that this resolution has formed the basis on which some meat inspectors have acted, but the enormous loss that the strict carrying out of the resolution would have entailed, and the result of numerous experiments on the infectivity of tuberculous meat made since then, have prevented, fortunately, its strict execution.

It would serve no useful end to detail the enormous number of experiments that have been made to arrive at a definite conclusion as to the infectivity of tuberculous meat, both in this country and abroad, within the last twenty years.

It is needful, however, to refer to the paper read by

Dr. Koch, in 1900, before the British Congress of Tuberculosis, in which he stated he would 'estimate the extent of infection by the milk and flesh of tubercular cattle, and the butter made of their milk, as hardly greater than that of hereditary transmission, and therefore does not deem it advisable to take measures against it.' Dr. Koch's position as one of the greatest scientists living, his past work, his discovery of the tubercle bacillus and of tuberculin, gave an authority to his statement which was world-wide. Those who were at the Congress were astounded, and the statement was at once telegraphed to every civilized country. There does not seem to be any evidence or justification for accepting his view in this case as correct. That human bacilli were not so virulent as bovine has long been known, and that in some cases the pathogenic power of particular bacilli from some people is very low had also been established. On the other hand, in almost every country numbers of cases had been recorded where the human tubercle bacilli had caused tuberculosis in cattle. A Committee was appointed by the United States Government, and a Royal Commission by the British Government and by the German Government, to investigate and report on Dr. Koch's statement. Among the results of the German Commission we find they state that out of thirty-nine different freshly-made cultures from tuberculosis in man, four were virulent and caused generalized tuberculosis in the cattle inoculated with them.

Dr. Salmon reports that, as the result of the United States Government's investigation, 'Dr. Koch wrote far beyond what was justified by any experiments or observations which he reported, and he did an immense amount of harm, which will be manifested for years to come, to those who endeavour to guard the human race from the dangers of animal tuberculosis. The researches to which your Committee has attended make these dangers more definite and certain than they have appeared before, and sanitarians should, therefore, most earnestly endeavour to counteract the erroneous and harmful impression which was made by Koch's address in London.'

In support of Dr. Koch's views, some bacteriologists have made a good deal of the difference in the morphological character of the tubercle bacilli which are derived from different animals, but there is no certain characteristic to depend upon to form a definite diagnosis. Bacilli taken from various sources and grown on various media show a great interchangeability of form. As a rule, the bacilli of bovine tuberculosis are shorter and less inclined to be beaded than those of human beings. The virulence of bacilli derived from different sources is very marked, and apparently that of bovine origin is much more active than that derived from human beings. Koch said that the virulence is so different that, although 'hitherto nobody could decide with certainty whether the tuberculosis of the intestine was of human or animal origin, now we can diagnose them. This method of diagnosis is to make cultures of the bacillus and subcutaneous inoculations of cattle with the cultures, the virulence of the bovine cultures being so very much greater than human that it rendered diagnosis possible.' Other experimenters find that there is a very wide range of virulence both in human and bovine bacilli, and that they frequently overlap each other in character. For practical purposes we cannot yet accept any definite diagnosis from this characteristic. The Interim Report of the British Royal Commission says:

'We have very carefully compared the disease set up in the bovine animal by material of human origin with that set up in the bovine animal by material of bovine origin, and so far we have found the one, both in its broad general features and in its finer histological details, to be identical with the other. We have so far failed to discover any character by which we could distinguish the one from the other; and our records contain accounts of the post-mortem examinations of bovine animals infected with tuberculous material of human origin which might be used as typical descriptions of ordinary bovine tuberculosis.

'The results which we have thus obtained are so striking, that we have felt it our duty to make them known, without further delay, in the present Interim Report.

'In the case of seven strains of human origin, the introduction of the human tuberculous material into cattle gave rise at once to acute tuberculosis, with the development of widespread disease in various organs of the body, such as the lungs, spleen, liver, lymphatic glands, etc. In some instances the disease was of remarkable severity.'

In Germany they have gone much further than merely saying that, as a rule, carcases affected with localized tuberculosis are to be passed, and with generalized tuberculosis to be condemned. What makes the meat injurious is the dissemination in it of the tubercle bacilli, and if these are destroyed, then its harmful nature will have departed. A joint that has been roasted or boiled will certainly have all the tubercle bacilli on the outside, and to a certain depth in its substance, destroyed, and such outside pieces will therefore have lost their harmful properties in the process. Unfortunately, the temperature to which the interior of the meat may have been raised in the roasting will not be so great as on the outside, and may not have been sufficient to kill the bacilli.

If exposed to steam in a closed chamber, on the other hand, for a certain length of time, the steam will penetrate to every fibre and destroy every organism. The plan is, therefore, to cut up meat which is affected with tuberculosis to such an extent that it would be dangerous to sell it in the raw condition, but yet which is not affected to such an extent as to require total destruction, into small pieces weighing 2 or 3 pounds. These are placed in a steam sterilizing apparatus on shelves. The doors are shut, and steam at a temperature of 212° F. is admitted into the apparatus, and allowed to remain in contact with the pieces of meat for about an hour, by which time the whole of the meat will have been sterilized. The penetration of the steam is assisted by allowing it to act intermittently by alternately shutting off and readmitting it. When the door is opened, a quantity of the steam will be found to have condensed, and as this forms a rich broth, having dissolved some of the extractive matters out of the meat, it is sold with the pieces.

Simple cooking, if carried out under proper supervision, is equally efficacious in sterilizing the pieces of meat, and in some places such cooking apparatuses are used.

Naturally, the method is applicable to many other conditions of diseased meat besides tuberculosis, but the apparatus was designed in the first place to enable a quantity of tuberculous meat to be sold which would otherwise have had to be condemned.

Such meat is then sold at a special stall, called a Freibank. This institution is peculiar, and requires a brief notice. It is intended for the sale of second-class meat—meat that is not unwholesome, but for which the purchaser should not have to pay the price of prime meat. Whether the sale takes place at the abattoir or at a shop in the city, a notice must be clearly written over the place as to the class of meat sold. Such meat must not be purchased by butchers or restaurant proprietors. It is intended for the very poor, who would probably have to dispense with meat altogether if they could not obtain it at a very cheap rate. At first the authorities were doubtful whether there would be any public which would be desirous of buying such meat, but experience has proved that there is, and now the demand is greater than the supply.

To show the utility of the Freibank, it may be stated that in at least five-sixths of the abattoirs in Prussia they are to be found.

The following are the regulations, based on the views that have been described, which guide the inspectors in France, Prussia, and Saxony in the condemnation of tuberculous carcases, and they can be compared with the recommendations of the Royal Commission on the same subject.

Seeing that in Great Britain the idea of sterilization or cooking of tuberculous meat has not been entertained, it will be noted that the recommendations formulated by the Royal Commission on this subject do not give quite the same latitude as do some of those already quoted; but they will, when generally adopted, remove much of the harshness complained of by butchers with regard to the action of medical officers of health in the past.

FRANCE.

The flesh of tuberculous animals is to be excluded, in whole or in part, from human consumption, according to the nature and extent of the lesions found, in accordance with the subjoined description.

They are to be seized and totally condemned—

1. When the tuberculous lesions, whatever their importance, are attended with wasting.

2. When there are tubercles in the muscles or in the glands in the muscular tissue.

3. When generalized tuberculosis is present, with miliary deposits on all the organs, and notably on the spleen.

4. When important tuberculous lesions exist at the same time both on the organs of the chest and of the abdominal cavity.

They must be seized, and partially excluded from human consumption—

1. When the tuberculosis is localized either in the thoracic or abdominal cavity.

2. When the tuberculous lesions, even though they exist at the same time both in the thoracic and abdominal cavities, are not extensive.

The seizure in this case only extends to portions of meat (costal or abdominal walls) which are directly in contact with the diseased portion of the pleura or peritoneum.

In every case the tuberculous organs must be destroyed, whatever the extent of the lesion.

In all cases meat that is fairly fat can be handed over to the owner, after being sterilized for at least an hour, either in boiling water or in a steam sterilizer; but the sterilizing must be carried on in an abattoir, under the control of a veterinary surgeon.

The Prefects of the Departments are charged with the execution of the present order.

PRUSSIA.

The flesh of tuberculous cattle is, as a rule, to be regarded as injurious to health if the muscular tissue contains tubercles, or if the tuberculous animal, without the presence of tubercles in the muscular tissue, is wasted.

On the contrary, the flesh of a tuberculous animal is to be passed (as not injurious to health) if the animal is well nourished, and (1) the tubercles are confined exclusively to one organ; or (2) if two or more organs are affected, these organs lie in the same body cavity, and are connected directly with one another, either by lymph-channels or by such bloodvessels as do not belong to the systemic circulation, but to the pulmonary or portal circulation.

SAXONY.

When tuberculosis is present in a high degree and extensive, with pronounced wasting, and when the condition of the flesh differs markedly from that which is healthy.

If it is generalized—that is, if the extension of the tuberculous process in the body has taken place only through the blood-stream (with the exception of the portal system), and the animal is at the same time markedly wasted, or the flesh and the bone or lymphatic glands belonging to them are studded with tubercles.

If it appears in the form of an acute generalized (embolic) miliary tuberculosis, accompanied by fever.

The recommendations of the Royal Commission are:

1. When there is miliary tuberculosis of both lungs	The entire carcase and all the organs may be seized.
2. When tuberculous lesions are present on the pleura and peritoneum	
3. When tuberculous lesions are present in the muscular system, or in the lymphatic glands embedded in or between the muscles	
4. When tuberculous lesions exist in any part of an emaciated carcase	
1. When the lesions are confined to the lungs and the thoracic lymphatic glands	The carcase, if otherwise healthy, shall not be condemned, but every part of it containing tuberculous lesions shall be seized.
2. When the lesions are confined to the liver	
3. When the lesions are confined to the pharyngeal lymphatic glands	
4. When the lesions are confined to any combination of the foregoing, but are collectively small in extent.	

In view of the greater tendency to generalization of tuberculosis in the pig, we consider that the presence of tubercular deposit in any degree should involve seizure of the whole carcase and of the organs.

In respect of foreign dead meat, seizure shall ensue in every case where the pleuræ have been 'stripped.'

The following circular, issued by the Local Government Board to local authorities, shows clearly that the want of uniformity in inspection calls for immediate attention:

'SIR,

'I am directed by the Local Government Board to state that they have had under consideration the Report of the Select Committee of the House of Commons on the Tuberculosis (Animals) Compensation Bill, 1904, in which reference is made (*a*) to the variety of practice alleged to exist with regard to the amount of tubercular deposit, the existence of which in a carcase is held to justify its total condemnation, and (*b*) to complaints made by butchers as to the injury caused to them by their prosecution in open Court for having tuberculous meat upon their premises.

'With regard to (*a*), it appears to the Board to be most desirable that there should be uniformity in the practice of meat inspectors in dealing with the carcases of cattle, and they have already on two occasions—viz., in their circular letters of March 11, 1899, and September 6, 1901—set out and urged the observance of the principles laid down by the Royal Commission on Tuberculosis, in their Report of 1898, with respect to the degree of tubercular disease which should cause a carcase or part thereof to be seized.

'The Board are of opinion that at the present time measures more stringent than those advocated by the Royal Commission are not called for, but they would impress upon the Council the expediency and desirability of insisting upon those of their officers who are employed as meat inspectors acting in strict accordance with the principles thus laid down, if this is not already the case.

'With regard to (*b*), the Select Committee expressed their view that if a butcher who is in possession of tuberculous meat has notified the fact to the proper authority as soon as he could be reasonably expected to be aware of it, the case should not be taken into Court.

'The Board understand that in some districts the course recommended by the Committee is followed now, but where this is not so the Board suggest that, having regard to the serious consequences which may result to a butcher from prosecution in open Court for being in possession of tuberculous meat, the Council should act upon the view expressed by the Select Committee in cases where such possession is voluntarily and promptly disclosed by the owner.'

CHAPTER IX

INSURANCE OF CATTLE FOR SLAUGHTER

In giving an account of the method of insurance by which the loss that must occasionally be suffered from the seizure of carcases when affected to the degree mentioned in the preceding chapter may be best met, it will be convenient to commence by describing the systems already in vogue in the United Kingdom.

It appears that for some years such insurance systems have been at work at Newcastle, Carlisle, and West Hartlepool in England, at Paisley and Aberdeen in Scotland, and at Belfast in Ireland.

In Newcastle and Carlisle the method adopted is very similar. Both are associations formed by the butchers in the usual way, with a president, treasurer, secretary, and committee of management. Any butcher may become a member on paying a premium of one shilling for every bullock or heifer and one shilling and sixpence for every cow slaughtered, and, in the case of the Carlisle Insurance Association, an entrance fee. Compensation is given to the amount of three-fourths of the value of the beast, but none is given in the case where the animal costs less than £8, nor for one purchased otherwise than in perfect good faith. Compensation is given for otherwise diseased conditions besides tuberculosis, or where the animal dies as the result of accident. Should the funds of the association at any time be unable to meet the compensation required, a levy is made on the owners of each beast slaughtered in that week to make up the deficiency.

In Carlisle, and, indeed, in most of the places named, the insurance association was avowedly started on account of the losses caused by seizure of tuberculous carcases.

In 1895 the sum of money paid in compensation for sixteen claims was £94 15s. 6d., and in 1896, for thirty-two claims, £209 8s. 5d. After the close of the first year, so good was the state of the finances of the association that the height of the premium was reduced to one shilling in the case of cows and to sixpence in that of bullocks and heifers. It became necessary, however, to re-establish the old premiums, owing to an increased number of seizures. Another interesting point brought out in connection with the Carlisle Association, in the evidence of Mr. Bell before the Royal Commission, is that such an association, consisting as it does of butchers, is the best agency for detecting cases of fraud on the part of its members. In Carlisle, as it was thought that one of the members was dealing in old cows for the sake of the compensation that he would get were they condemned, the £6 limit for compensation was raised to £8.

In Newcastle the insurance was commenced in 1892, and since that date 22,764 animals have been insured, of which only eight have been surrendered. The total amount paid in compensation has been £70, thus leaving no less a sum than £827 12s. 9d. (over 90 per cent. of the sums received) to be redistributed among the forty members.

The explanation of the small number of seizures in this case is the fact that most of the animals insured were of a good class, and no compensation is given for an animal costing less than £8.

In West Hartlepool the insurance society was formed in 1891, with a membership of forty. The premium charged is one shilling for a cow and sixpence for a bullock. In the course of six years fifty-two claims have been paid, amounting to £440 9s., and the system has worked very satisfactorily, until of late some members who had had no seizures objected to paying money to compensate others who had. Two-thirds of the value of the beast is given in compensation for seizure. The number of seizures for tuberculosis (and the payment of compensation is limited to this disease) has been gradually increasing, the numbers being four in 1891 and 1892, eleven in 1893, ten in 1894, five in 1895, and fifteen in 1896.

In Paisley the premiums charged are threepence for a bullock or heifer, sixpence for a bull, and one shilling for a cow, but the society has the power of raising these charges if the fund requires it. One-half the value of the animals is given, but not unless the animal cost more than £8. This limit, however, is a variable one, subject to current market values. Since the society has been in operation fifty-one claims have been paid, amounting to about £300. Mr. Scarlett, the secretary, stated in his evidence before the Royal Commission that as far as its operations had gone they had been quite successful. It was, however, not taken advantage of by all the butchers, and its activity has been largely affected by a compulsory system of insurance on the part of the auctioneer.

The auctioneer charges on every cow put through his ring two shillings (one shilling from the buyer and one shilling from the seller), and one shilling on every bullock or heifer (sixpence from the buyer and seller respectively), and a somewhat similar arrangement has been employed in the auction markets at Aberdeen. The system has the advantage of compulsion, and it is improbable that the charge of sixpence for a bullock and one shilling for a cow would be appreciably felt by either the butcher or farmer, in view of the three-fourths compensation he would receive in case of total seizure.

It is evident, then, from a consideration of the above facts, that insurance in this country has not passed much beyond the experimental stage. All the weight of the National Federation of Butchers has been thrown against any extension of the scheme, on the ground that they would, by advocating it, be cutting the ground from under their feet as regards compensation from Imperial or local funds. But if the losses are so considerable that they exert a crippling effect on dealers in home-fed beasts, seeing that the majority of the Royal Commission report unfavourably on the subject of compensation, insurance offers the best way out of the difficulty.

Passing from this country to Germany, it will be found that the subject is there fully worked out on an extensive scale, and is no longer experimental.

It must be premised that there, as a rule, the farmer, and not the butcher, suffers the loss from seizure, as payment is not made by the latter to the former until after the carcase has been passed by the inspector. The subject, further, is less difficult to deal with in Germany, because public slaughter-houses are more the rule than in this country, and consequently the collection of premiums and means of checking fraud are easier to effect.

But the growth of these insurance societies has been necessarily brought about by increased uniformity of inspection, and by means of them the apparent hardships inflicted on owners by seizures have been almost entirely alleviated. The view of the matter taken in Germany is that if the State will not organize insurance or give compensation for tuberculosis, as in the case of animals affected with other contagious disease (and the State so far has shown no disposition to do so), then the interested parties must protect themselves as best they can. Unremitting efforts have been made to induce the various States to organize a system of insurance, but so far Bavaria and Baden alone have dealt with the matter. Agriculturists there maintain that unless the insurance is made compulsory it will be a failure, and they urge that the organization for the insurance of cattle should be as all-embracing as possible, in order to protect the small owners.

In Baden the law of 1890 led to the establishment of district insurance offices, but under the condition that when once started they should not be dissolved until after the lapse of seven years. It was considered desirable that the State should exercise a certain amount of control and supervision over these offices, because the loss of an animal to a farmer in poor circumstances might lead to a serious diminution in his capital, and to his borrowing at an exorbitant interest.

Every cow must be insured as soon as the office has been established, and any loss must be defrayed by the office. In the case where several district insurance offices agree to amalgamate, then the insurance office of the particular district bears one-quarter of the loss, and the remaining three-quarters is distributed among the others.

It is evident that the knowledge the officials of the insurance society would gain as to the prevalence of the disease in a particular district might be utilized very easily to bring about a better state of things. In most towns where there is a public slaughter-house, as, for example, in Leipzig, Berlin, Dresden, and Halle, there are insurance offices against loss by condemnation of carcases, managed either by the slaughter-house authorities themselves, or by the Butchers' Union, or by the farmers and butchers banding together.

As an instance, the chief rules of the Cattle Insurance Association having its headquarters in Berlin may be given:

1. The insurance of cattle destined for slaughter belonging to the cattle-dealers of Berlin has been founded to protect the owners of cattle, by the payment of a premium, from the great losses to which they are exposed, owing to the rigorous measures of the veterinary inspectors at the abattoir.

2. The association is not started for purposes of gain. The premium to be paid, therefore, is regulated every month, according to the number of seizures, and published on the first of each month in the abattoir.

In February, 1895, this was eight shillings for a cow, six shillings for a bull, and two shillings for a bullock or heifer.

3. No person is allowed to insure who does not promise in writing to insure the whole of his cattle coming to the slaughter-house.

4. Animals cannot be insured which have been injured during transit, or have been transferred as suspicious by the veterinary inspectors to the contagious disease isolation slaughter-house, or are markedly wasted or recognised as diseased by the veterinary inspectors.

5. The compensation paid is the full market price of the animal. If the carcase is not wholly condemned,

then the price of the portions which are allowed for sale must be deducted.

6. The liability of the society ceases if the animal is not slaughtered within twenty days.

7. The director is justified in refusing the privileges of insurance to those who he is convinced will cause damage to the office, or to those not acting in good faith.

TABLE OF PREMIUMS OF DIFFERENT INSURANCE SOCIETIES.

Place.	Cattle.	Amount of Compensation.	Nature of Insurance Office.
Dresden -	Bulls Oxen } 3s. Cows, 6s,	Full market price and slaughter-house charges.	Butchers' Union.
Göttingen	Bulls Oxen } 4s. Cows, 5s.	,, ,,	Cattle Insurance Association.
Halle -	For members, 3s. For non-members, 6s.	,, ,,	Cattle Insurance Association, with limited liability.
Leipzig -	Oxen Bulls } 7s. 6d. Cows, 9s. 6d.	,, ,,	Municipal Association for Insurance of Cattle.

It will be seen that the amount of the premiums varies considerably, being dependent, no doubt, on the character of the animals brought to the slaughter-house, and to the greater or less degree of stringency in inspection.

In Leipzig, for instance, by far the largest number of cattle brought to the abattoir are old cows and oxen, which are much more liable to be affected with tuberculosis than younger cattle.

The following figures, taken from the annual report of the Dresden slaughter-houses, shows the actual status of the association :

PARTICULARS EXTRACTED FROM THE REPORT OF THE BUTCHERS' UNION OF DRESDEN.

Number of Animals brought to the Market.

Oxen	12,251
Bulls	7,721
Cows and heifers	8,982
	28,954
Swine	134,579
Sheep	53,265
Calves	62,093
Goats	26
Total	279,277

RESULTS OF THE INSURANCE OFFICE FOR CATTLE UNDER THE COMBINED MANAGEMENT OF THE BUTCHERS' UNION AND A COMMISSION OF THE CATTLE-DEALERS.

	Number Insured.	Premiums Paid.
		£
Oxen	10,172	—
Bulls	6,721	—
Cows and heifers	5,858	—
Total	22,751	£5,566

In addition to these, over 3,500 cattle were insured; but as they were removed from the cattle market to be slaughtered elsewhere, the premiums, less 1 mark, were returned.

Compensation was paid in the following cases, owing to veterinary condemnation:

	Totally Destroyed.	Freibank.	Livers.	Tongues.	Lungs and Heart.	Spleens.	Udders.	Various.	Amount Paid.
									£
Oxen	17	147	870	45	18	49	—	98	4,418
Bulls	15	89	310	36	13	29	—	30	2,325
Cows and heifers	31	248	649	21	21	49	32	160	4,451
Total	63	484	1,829	102	52	127	32	288	£11,194

£4,486 was, however, realized by the sale of meat on the Freibank and by the utilization of the condemned carcases, etc., so that the total amount of the claims paid out of the insurance fund was £6,608.

The heavy losses which the office suffered led, in addition to the expenditure of £650 from the reserve fund, to the lowering of the compensation for livers from 8 to 6 marks, and the raising of the premiums on oxen to 5 marks, bulls to 6 marks, cows and heifers to 8 marks, making the total loss to the office for the year £905.

Besides these special insurance societies, quite a number of the public insurance offices undertake insurance against loss which may be sustained through the condemnation of cattle in the abattoirs. They have agents in the principal towns, and there seems no reason why live-stock insurance societies in the United Kingdom should not extend their lines in the same direction; but it must be observed that private unions inaugurating an insurance fund can work much more economically than societies which carry on insurance as a business. In the former the expenses of management are small, because, with the exception of the veterinary surgeon and clerk, all the appointments are honorary. The larger the number of parties interested who can be induced to join, the lower will be the premiums that will have to be charged, and on this ground the plan is to be highly recommended of farmers, butchers, and cattle-dealers all uniting to form the insurance fund.

It should be clearly understood, if the insurance office is to be of real value, that (1) all animals, before being insured, must be examined, and only those be accepted which are without visible signs of disease; (2) that carcases which are presented for examination of animals that have not been seen alive shall be excluded; (3) that there should be a Freibank or similar institution for the sale of second-class meat; and (4) that there should be arrangements for utilizing to the full for trade purposes carcases totally excluded from human consumption.

It will be found in practical working that the premiums which have to be paid will vary according to whether cattle are kept in sheds or houses a great part of the year or whether they live all the year round in the open.

Where the cattle are kept in sheds, and where there are a number of stall-fed cows, the premiums must be high. In the West of England local auctioneers take the risk of any cattle which they sell being condemned, and charge 1s. per head for all the cows and bulls and 6d. per head for all the young stock they sell as insurance premiums, and then refund the cost of the animal if the carcase is condemned. This plan seems to be working very satisfactorily. We want a uniform standard of meat inspection in England; it will then be much easier for the insurance companies to fix a premium. At present the change of a local inspector may increase the number of animals condemned to a very great extent, and this uncertainty has had a great deal to do with preventing a more extensive system of insurance than prevails at present.

In conclusion, I believe that tuberculosis can be greatly reduced or almost eliminated, and that if all available means were utilized to this end the progress would be both extensive and rapid, and great benefit be conferred on the human race.

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